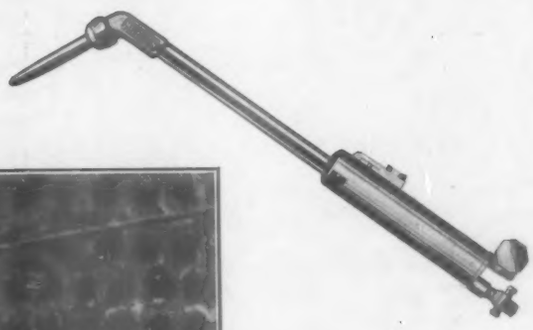
The Welding Engineer

Founded by L. B. Mackenzie, 1916

JUNE, 1926 VOL. 11, No. 6

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. Reg. U. S. Pat. Office $4.00 per year abroad

Here's a Torch— gratis!



CUTTING STAYBOLTS

The Milburn Combination Torch is practically two torches in one. It cuts and welds any commercial thickness of metal by a mere change of tip. It performs all the work of two separate torches.

So in reality, the purchase of a Milburn Combination Cutting and Welding Torch means two torches to your operator—at the price of one.

This torch has established world's records in cutting staybolts and rivets and operates with greatest efficiency and economy on all operations. Adopted as standard by largest industrials, railroads and government departments.

Bronze forgings and the latest scientific methods are used in the construction of Milburn Torches, Regulators, Generators and other equipment. Let us tell you how to economically apply this torch to your problem.

Catalog 35T on request

THE ALEXANDER MILBURN CO.
BALTIMORE, MD.

WORLD'S BEST
MILBURN
ESTABLISHED 1907

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill. Under the Act of March 3, 1897.

If you must use your blowpipe as a hammer

or leave it in the road to be smashed by the factory truck, pick up the pieces and send them to the nearest Oxweld apparatus repair station.

There are 21 Oxweld repair stations throughout the country. One of them is near you. Mail or express your blowpipe direct to this nearest station and it will be back in service before you know it, for a nominal charge.

Oxweld repair stations are factory supervised and give the same careful service that you would get from the factory direct. Saving time and money for our customers is our main reason for establishing them.

OXWELD ACETYLENE COMPANY

Chicago	Long Island City, N. Y.	San Francisco
3642 Jasper Place	Thompson Ave. & Orton St.	1050 Mission Street

OXWELD
Apparatus Repair Stations

Baltimore
Birmingham
Boston
Buffalo
Chicago
Cleveland
Denver
Detroit
Houston
Los Angeles
Minneapolis
Newark
Omaha
Philadelphia
Pittsburgh
Portland
St. Louis
Salt Lake City
San Francisco
Seattle
Tulsa

Oxweld

WELDING AND CUTTING APPARATUS

When you use a cylinder of oxygen bearing this stamp

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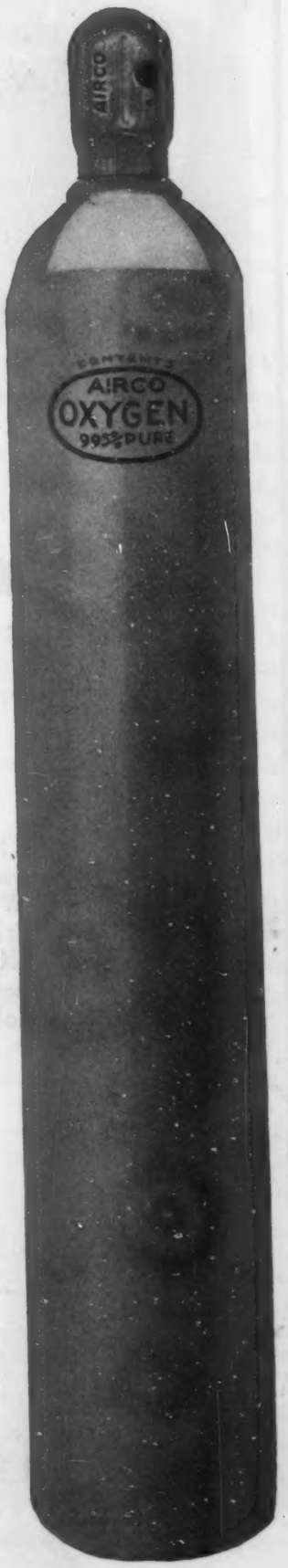
AIRCO OXYGEN 99.5% PURE



You have a 10% saving in time and a 10% saving in oxygen, compared with oxygen of one-half of one per cent (0.5%) less purity in metal cutting.

As evidence that a company with national distribution is giving to you the opportunity to profit by the higher efficiency of 99.5% oxygen, your Airco oxygen cylinders will be marked with this tag guaranteeing the quality of the oxygen contained in the cylinder.

Air Reduction Sales Company

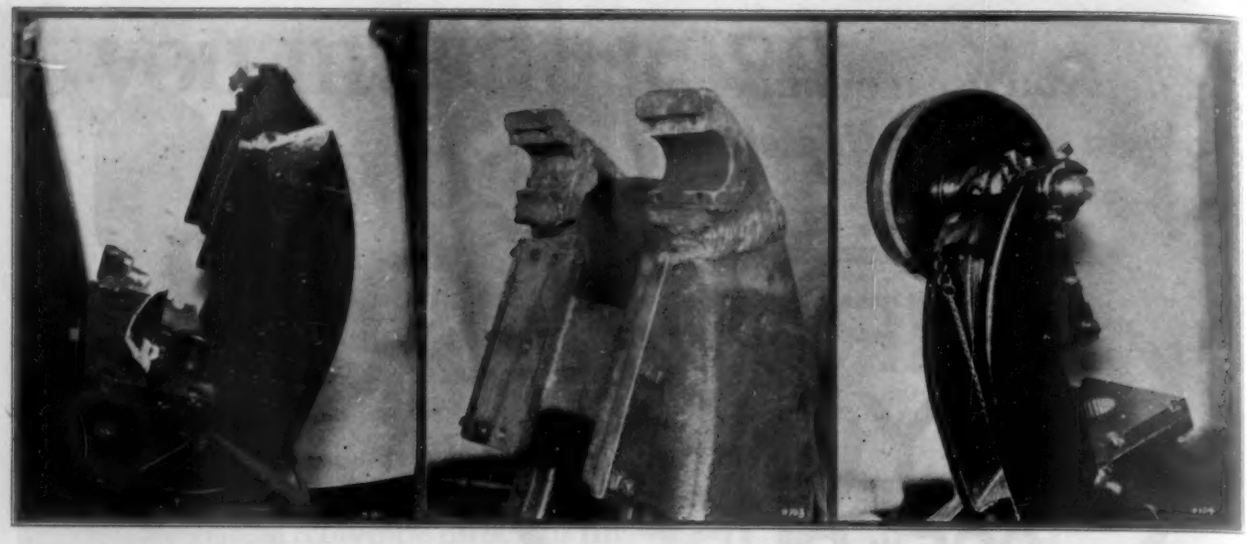
HOME OFFICE—342 MADISON AVE., NEW YORK CITY

With 51 Plants, 320 Distributing Stations, Manufacturing and Distributing

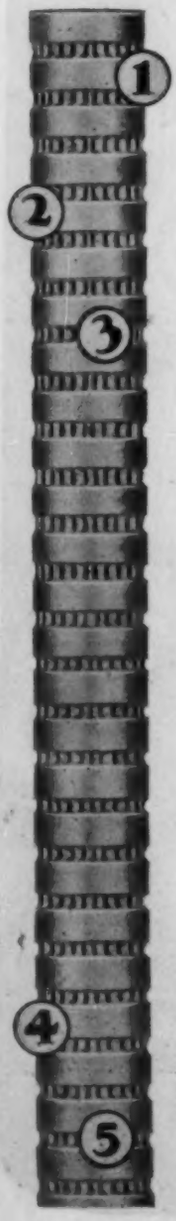
Oxygen, Nitrogen, Argon, Neon, Calorene, Acetylene Airco-Davis-Bournonville Welding and Cutting Apparatus, Airco-National Carbide

District Sales Offices

Birmingham	Chicago	Jersey City	Minneapolis	Richmond
Boston	Cleveland	Los Angeles	Oklahoma City	St. Louis
Buffalo	Detroit	Milwaukee	Philadelphia	Seattle
	Emeryville, Cal.		Pittsburgh	



Broken cast iron punch press restored to service with Koro Special Black Coated Mild Steel Rod.



A Greater Distribution Service for

"KORO"

WELDING ELECTRODES

Through the purchase of the Koro Electric Corporation, the Lincoln Steel Company, have become exclusive manufacturers of the KORO Welding Electrodes. A nation wide distribution service is now being arranged by the appointment of selling agents in all large cities. KORO Welding Electrodes have amazingly high welding quality because, in contrast to ordinary arc welding wire, they possess the following advantages.

1. **Corrugation**—the rod is corrugated at regular intervals before the coating is applied. These corrugations set up crystallization zones which vary the resistance, causing the desirable cupping action at the arc.

2. **Range**—Special metal can be supplied for practically any type of work and subsequent runs are held strictly to specification.

3. **Coating**—this high-temperature-resisting mineral substance is applied under great pressure. It's free from silicon, is a conductor of electricity (no bare spot required) and resists rough handling, will not flake off. In action the Koro coating stays on right down to the arc; ordinary coatings fuse faster, melt away from the end, giving the effect of bare wire.

4. **Speed**—Koro rods work best at reduced amperage, proving their claim to unusual penetration and speed.

5. **Arc Action**—The Koro coating stays on right down to the arc, deoxidizes the atmosphere around the weld; the corrugations produce a current lag; the metal in the rod is pure—as a result of all the factors, a larger and straighter arc can be maintained. Less spattering of metal, less eye strain.

LINCOLN STEEL COMPANY

2320 W. 58th St. CHICAGO, ILL.

We have a real attractive proposition for welding supply dealers in several territories and are selecting sales agents with great care. If you can handle a fast seller, write for details of our agency contract.

The Welding Engineer

Founded by L. B. Mackenzie, 1916 — Reg. U. S. Pat. Office

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The Great Show Place

BUSINESS papers bring to your door the displays of the firms who make equipment and materials in which you are most interested. At your leisure you can study the construction or the advantages of various makes and arrange for a closer inspection to suit your convenience. THE WELDING ENGINEER is the great show place of America for equipment and supplies used in every welding process. It keeps you posted on new developments and makes you acquainted with those progressive firms who use the great power of advertising to reduce their selling costs, in order to give the buyer the greatest possible value for each dollar invested. You do not go far in these advertising pages until you realize that you are in the company of the leaders in the industry. You can put your welding problems in their hands with full confidence that their interest in serving you is sincere. Men who make welding history seek your acquaintance here, more of them than you can ever find assembled elsewhere.

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Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

CLEVELAND—R. K. Randall, 2200 Prospect Ave.
DENVER—A. G. Odell, Public Opportunity School.
GREAT BRITAIN—Capt. D. Richardson, 30 Red Lion Square, Holborn, London, W. C. I.
AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

OXECO

Liquefaction Oxygen Producing Plants

Efficient Plant Operation in Accordance with Oxygen Demands

In order to meet various conditions encountered in the oxy-acetylene industry, OXECO Plants are made in many different sizes and types.

The usual commercial oxygen plant installation is designed for continuous operation and is of a type that will yield a steady volume of high purity oxygen with the lowest possible production costs. A different type plant is required for industrial installations where there must be efficient but intermittent operation in accordance with the fluctuating daily demands of a large consumer.

In either case 99.7% pure oxygen can be most efficiently produced by an OXECO Production Unit of suitable size and type.

The smallest OXECO Plant has a capacity of 250 cubic feet per hour and is suitable for any oxygen consumer in an isolated community where transportation costs make the price of oxygen in cylinders prohibitive.

The largest OXECO Unit has a capacity of 70,000 cubic feet, per hour. Such plants are intended for the production of large volumes of oxygen at an extremely low cost to be used for air enrichment or in connection with any process where pure oxygen in terms of tons is desired.

99.7% PURE OXYGEN

Oxygen users now demand 99.5% pure oxygen. OXECO Plants are guaranteed to exceed this usual demand for high purity and in the case of most installations, 99.5% is the absolute minimum.

SERVICE

OXECO Plants are completely covered by responsible guarantees and are backed by a real service organization. Repair parts or service engineers, if needed, are instantly available. No effort has been spared to build up an organization competent to handle any demands made by the oxy-acetylene industry.

More Oxeco Plants Have Been Installed Than Any Other Type of Oxygen Producing Equipment

KEITH DUNHAM COMPANY

110 South Dearborn Street ∴ Chicago

OXECO

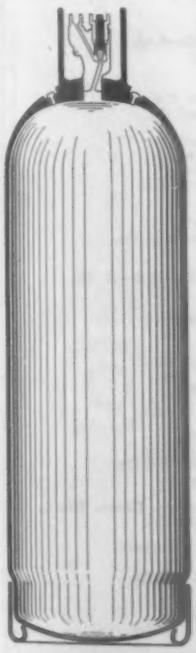
Seamless, Monolithic Filled Acetylene Cylinders

Eighteen months ago we began manufacturing seamless, monolithic filled acetylene cylinders. We believed that the 100% safety record of cylinders of this type during the past ten years, justified their general adoption by the acetylene industry provided such cylinders could be sold at a price well within the reach of the independent acetylene manufacturers. The fact that within the past few weeks we have been forced to double the original capacity of our cylinder factory indicates the fulfillment of our expectations.

An acetylene cylinder consists of two elements, namely, the shell and the porous filler. There are sound engineering reasons why the entirely seamless steel shell and monolithic filler are superior to any other known construction.

In drawing and spinning the shell out of one piece of carefully selected steel, the strength of every part of such shell is under absolute control. At no point is the strength an unknown quantity and we know positively that such a cylinder cannot possibly fragment under any circumstances. If exposed to fire, dropped or otherwise abused in service, an Oxeco cylinder shell cannot do otherwise, than stay in one piece.

Monolithic filler is a porous, stone-like mass that is generally recognized in the industry as being the perfect filling material for acetylene cylinders. Such filler cannot disintegrate or sag, consequently voids never occur in cylinders properly filled with this material.



Acetylene manufacturers who must spend thousands of dollars for cylinders, naturally want cylinders that are designed on the basis of sound engineering. From a purely investment standpoint, it is certainly advantageous to spend money for cylinders that will last indefinitely due to the fact that neither the seamless shell nor the monolithic filler contains any inherent structural weaknesses. Then there is the satisfaction of being able to assure customers that they are getting acetylene in the most modern cylinders on the market; a type that has a 100% safety and service record.

The following acetylene manufacturers are using OXECO seamless, monolithic filled cylinders:

Acetylene Gas & Supply Co., Toledo, Ohio.

Acetylene Products Co., El Paso, Texas.

Acetylene Service Co., Denver, Colo.

Acme Oxy-Acetylene Co., Chicago, Illinois.

Compressed Acetylene Co., Louisville, Kentucky.

California Compressed Gas Co., Los Angeles, California.

Gas Products Co., Columbus, Ohio.

Grand Rapids Welding & Supply Co., Grand Rapids, Michigan.

Hawaiian Gas Products Co., Honolulu, Hawaii.

Indiana Oxygen Co., Indianapolis, Indiana.

Louisiana Oxygen Co., New Orleans, Louisiana.

Magnolia Gas Products Co., Houston, Texas.

Midwest Oxygen Co., Portsmouth, Ohio.

Ohio Valley Oxygen Co., Cincinnati, Ohio.

Pacific Acetylene Co., San Diego, California.

Portsmouth Oxygen Corp., Portsmouth, Ohio.

Southern Oxygen Co., South Washington, Virginia.

KEITH DUNHAM COMPANY

110 South Dearborn Street ∴ Chicago

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS
Keith Dunham Company
Pressed Steel Tank Co.

AIR LIQUEFACTION OXYGEN PRODUCING PLANTS
Keith Dunham Company
Heylandt Sales Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Aluminum Fix Co.

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec & Mfg. Co

APRONS (Asbestos)
Ideal Face Shield Co.
Safety Equipment Service Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches."

BOOKS
The Welding Engineer Pub. Co.
Electric Arc Cutting & Welding Co.

BRAZING OUTFITS
Air Reduction Sales Co.
Carbic Mfg. Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Alexander Milburn Co.
Oxweld Acetylene Co.
Sutton-Garten Co.
Torchweld Equipment Co.

BRONZE FILLER RODS
American Brass Co.
Central Steel & Wire Co.
Steel Sales Corp.

BUFFERS
N. A. Strand & Co.
Wodack Electric Tool Corp.

CABLE (Arc Welding)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
Seneca Electric Arc Welder Co.
H. E. Steinbock
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CARBIDE
Air Reduction Sales Co.
Shawinigan Products Corp.
Union Carbide Sales Co.

CARBIDE (Compressed in Cakes)
Carbic Mfg. Co.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Electric Arc Cutting & Welding Co.
Harris Calorific Co.
National Carbon Co.
Oxweld Acetylene Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
Carbic Mfg. Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander Co.
Oxweld Acetylene Co.
Sutton-Garten Co.
Torchweld Equipment Co.

CAST IRON SOLDER
Aluminum Fix Co.
Johnson Laboratories.

CONSULTING ENGINEER
E. F. Hollinger

CONTROLLERS (For Arc Welders)
Electric Welder Controller Co.

CUTTING ELECTRODES (Electric Arc)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Keith Dunham Company
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Wm. Wharton, Jr. Co.

DRILLS, PORTABLE ELECTRIC
N. A. Strand & Co.
Wodack Electric Tool Corp.
Stoody Company

ELECTRIC ARC WELDING OUTFITS
Allan Mfg. & Welding Co.
Aluminum Fix Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Goodman Electric Machinery Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Seneca Electric Arc Welder Co.
H. E. Steinbock
Sutton-Garten Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
Lincoln Steel Co.
Page Steel & Wire Co.
H. E. Steinbock
Reid-Avery Co.
Roebling, John A., Sons Co.
Steel Sales Corp.
Seneca Electric Arc Welder Co.
Seneca Wire & Mfg. Co.
Stoody Co.
Stulz-Sickles Co.
Sutton-Garten Co.
Una Welding and Bonding Co.
Wickwire-Spencer
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
Aluminum Fix Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Northwestern Mfg. Co.
Seneca Electric Arc Welder Co.
H. E. Steinbock
Stoody Co.
Sutton-Garten Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon Works, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

FACE SHIELDS (Arc Welding)
Allan Mfg. Co. & Welding Co.
Aluminum Fix Co.
American Optical Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Safety Equipment Service Co.
Seneca Electric Arc Welder Co.
H. E. Steinbock
Strauss & Buegeleisen
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

FILLER RODS
Air Reduction Sales Co.
American Brass Co.
Central Steel & Wire Co.
Oxweld Acetylene Co.
C. H. Hollup Corp.
Lincoln Steel Co.
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Steel Sales Corp.
Seneca Wire & Mfg. Co.
Stoody Co.
Stulz-Sickles Co.
Sutton-Garten Co.
Torchweld Equipment Co.
Wickwire-Spencer

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
Joseph Dixon Crucible Co.
National Carbon Co.
U. S. Welding Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Hoxite Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

GLOVES (Asbestos)
Ideal Face Shield Co.
Safety Equipment Service Co.

GAUGES
National Gauge & Equipment Co.
U. S. Gauge Co.

GENERATORS (Acetylene)
Air Reduction Sales Co.
M. Keith Dunham
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Oxweld Acetylene Co.

GOGGLES
American Optical Co.
Ideal Face Shield Co.
Safety Equipment Service Co.
Strauss & Buegeleisen

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
N. A. Strand & Co.
Wodack Electric Tool Corp.
Stoody Company

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
Aluminum Fix Co.
Burke Electric Co.
Electric Arc Cutting & Welding Co.
Fibre-Metal Products Co.
General Electric Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Safety Equipment Service Co.
Seneca Electric Arc Welder Co.
H. E. Steinbock
Strauss & Buegeleisen
Sutton-Garten Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

SWEDOX

WELDING RODS, WIRES and ELECTRODES

SWEDOX Welding Rods and Wires, differing widely in chemical and physical properties, have one common quality. Each brand is made for a particular welding requirement.

When you consider the care that must be exercised in the selection of metal for different construction requirements, it becomes apparent that equal care is necessary in selecting filler material for welding the joints in these constructions.

The SWEDOX line has been developed so as to furnish on each welding job the welding wire which will enable the welder to get the most satisfactory result. There is a SWEDOX wire for your work. Try it, and you'll know why SWEDOX customers come back.

Central Steel & Wire Company

CHICAGO, ILL.
4545 S. Western Blvd.
Lafayette 8500

DETROIT, MICH.
5001 Bellevue Ave.
Lincoln 6780

Main Warehouses and General Offices, Central Steel & Wire Co., Chicago.

HYDROGEN
Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Sutton-Garten Co.
Torchweld Equipment Co.
U. S. Welding Co.

LIGHTERS (For Gas Torches)
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Stevenson Distributing Corp.
Torchweld Equipment Co.
U. S. Welding Co.

MANIFOLDS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
Gas Products Association
International Oxygen Co.
Linde Air Products Co.

OXYGEN PRODUCTION PLANTS
Keith Dunham Company
Heylandt Sales Co.

PREHEATING DEVICES AND OVENS
Metal & Thermit Corp.

RAIL BONDS
Una Welding and Bonding Co.

RAIL JOINT WELDERS
Una Welding and Bonding Co.

REAMERS (Portable Electric)
N. A. Strand & Co.
Wodack Electric Tool Corp.

REGULATORS
Air Reduction Sales Co.
G. & G. Brass Mfg. Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Sutton-Garten Co.
Torchweld Equipment Co.

SCHOOLS (Correspondence)
Kerr's Welding School

TANK CONNECTIONS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Sutton-Garten Co.
Torchweld Equipment Co.

TRUCKS (Cylinder)
Air Reduction Sales Co.
International Oxygen Co.
Torchweld Equipment Co.

VALVES
Air Reduction Sales Co.
International Oxygen Co.

WELDING COMPOUND (for Shape Welding)
Air Reduction Sales Co.
Harris Calorific Co.
Joseph Dixon Crucible Co.
National Carbon Co.

WELDING ROD HOLDERS
Stoody Co.
C. Sorensen

WELDING RODS AND WIRE
See "Electrodes" and "Filler Rods"

There's No Waste Motion Here

YOU can undoubtedly reach a large number of good firms through an advertising campaign which is concentrated in papers reaching selected industries, and reach along with them thousands of readers who are not and never will be concerned with welding—that's waste. You pay a needlessly high price for the interest that's there, and you make a decidedly less effective impression on that interest than if you used a less expensive campaign in **The Welding Engineer**, which reaches the concentrated interest of the country. In these pages you talk to the **right man**, in the **right plant**, at the **right time**. That's efficiency.

Ask for a copy of "The Welding Industry"

The Welding Engineer 608 S. Dearborn St., Chicago

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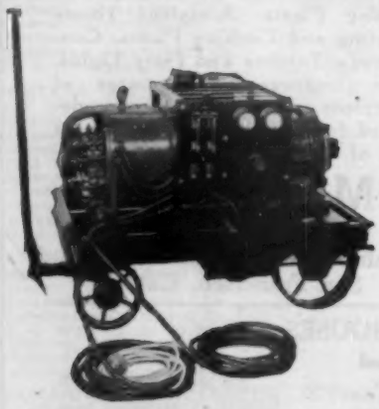

Wilson Type S Single-Operator Motor-Driven Electric Welding Machine. Designed for both production and repair work. Adapted for use wherever power is available. Capacity, 25 to 250 amperes.

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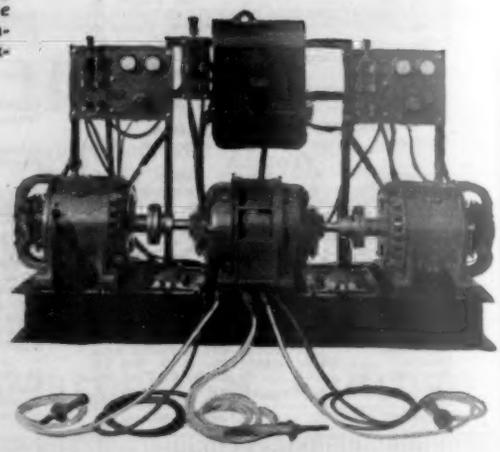
Type S Features

Every Wilson Type S machine has a simple, compact control panel; a *self-exciting* generator; an arc that is easy to strike and easy to maintain; a current adjustment by a simple turning of a field rheostat knob; a commutator that always shows *less temperature rise than any other part of the machine.* The welding current can be reduced to as low as 25 amperes for welding thin-gauge metals.



Wilson Type S Two-Operator Stationery Motor-Driven Electric Welding Machine, heavy duty type. Capacity, 25 to 500 amperes.

With its simple construction, close regulation, rugged strength—*superior engineering throughout*—the Wilson Type S has proved itself a *better welding machine.* Its features—many of which are found in no other machine—make the Wilson Type S the choice for practically every kind of welding. And you can select the Wilson welding machine that meets your own operating conditions. Read descriptions above, and write today for full information and prices.

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WELDING MACHINES AND WELDING WIRE

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"Color-tipt"

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for All Arc Welding

Select *the* Right Grade *for* Each Job

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Diameter Size: 5/32"

For flat, vertical and overhead welding. This wire will produce an extremely hard surface on steel and is not machineable. For use where resistance to wear is an important factor—Guides, Rock-Crusher Jaws, Frogs, Rail Heads and Switch Points.

No. 6

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No. 9

GRADE COLOR "BLUE"

Diameter Sizes: 3/16", 5/32", 1/8"

For flat, vertical and overhead welding. This wire will produce a weld in steel of over 60,000 lbs. per square inch tensile strength and an elongation of about 15% in one inch in a mechanically sound weld. Machineable at reduced tool speed. For Automobile Frames, Boiler Plate, Cast Steel Parts, Locomotive Frames, Fire Box Seams, Flue Sheet Patches, High Pressure Boiler Work, Oil Pipes, Gas and Steam Pipes, Ship Plates, Tanks, Fish Plates, and Rail Bonds.

No. 20

GRADE COLOR "BROWN"

Diameter Sizes: 5/32", 1/8"

For flat welding only. This wire will produce a weld in brass, bronze, and light gauge copper. For Pump Castings, Water Wheels, Motor End Rings, Tail Shaft Sleeves, Bearings, and Castings.

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GRADE COLOR "ALUMINUM"

Diameter Size: 5/32"

For welding Sheet Aluminum minimum No. 11 gauge (⅛"). Also for Cast Aluminum minimum thickness 3/16".

No. 12

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Diameter Sizes: 5/32", 1/8", 3/32"

For flat welding only. This wire will penetrate cast iron and produce a homogeneous and machineable weld. Readily caulked when cold.

MONEL METAL—WILSON PROCESSED

Diameter Sizes: 5/32", 1/8", 3/32"

For welding Monel Metal and Monel to Steel.

No. 17

GRADE COLOR "RED"

Diameter Sizes: 1/4", 3/16", 5/32", 1/8", 3/32"

For flat, vertical and overhead welding. This wire will produce a sound weld in cast iron where studs are used and in steel a weld of about 50,000 to 55,000 lbs. per square inch tensile strength. On steel it is easily machineable. For Flue Work, Steel Castings, Blow Holes in Gray Iron Castings.

WILSON WELDER & METALS CO. INC.
Wilson Bldg. Hoboken, N. J.

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WILSON

WELDING MACHINES AND WELDING WIRE

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†*Fresno—California Compressed Gas Co.
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†Oakland — California Compressed Gas Co.
†*Redding — California Compressed Gas Co.
†*Sacramento—California Compressed Gas Co.
†*San Francisco — California Compressed Gas Co.
†*San Jose — California Compressed Gas Co.
†*Stockton — California Compressed Gas Co.

COLORADO
†Denver—Colorado Compressed Gas Co.

GEORGIA
†Atlanta—Burdett Oxygen Co.

ILLINOIS
†Chicago—Acme Oxygen Co.
†Burdett Oxygen & Hydrogen Co.
†Swift and Company.
†Peoria—Electrox Co.

INDIANA
†*Evansville—Kentucky Oxygen-Hydrogen Co.
†Indianapolis—Indiana Oxygen Co.
Logansport—Logansport Oxygen Co.
†*South Bend—Burdett Oxygen-Hydrogen Co.

IOWA
†Bettendorf — Bettendorf Oxygen-Hydrogen Co.

KENTUCKY
†Louisville—Kentucky Oxygen-Hydrogen Co.

LOUISIANA
New Orleans—Louisiana Oxygen Co.
Shreveport — The Bain-Beaird Co.

MARYLAND
†*Baltimore—Southern Oxygen Co.

MASSACHUSETTS
†Everett—New England Compressed Gas Co.

MICHIGAN
†Detroit—Burdett Oxygen Co. of Detroit.
Wall Bros. Co.
*Grand Rapids—Grand Rapids Welding & Supply Co.
Muskegon — Michigan Oxy-Hydric Co.

MINNESOTA
†Minneapolis—Commercial Gas Co.

MISSOURI
†Kansas City—Kansas City Oxygen Gas Co.
†Ox-Hydrogen Mfg. Co.

MONTANA
†Butte—Mountaineers Welders' Supply Co.

NEBRASKA
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NEVADA
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†Newark — International Oxygen Co.
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†*Paterson—International Oxygen Co.
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†*Brooklyn— International Oxygen Co.
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NORTH CAROLINA
Charlotte—Carolina Standard Gas Products Co.

OHIO
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*Philadelphia—Burdett Oxygen Co.
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†*Knoxville—Kentucky Oxygen-Hydrogen Co.
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†*Nashville—Kentucky Oxygen-Hydrogen Co.
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*Waco—Burdett Oxygen Co. of Texas.
*Wichita Falls—Burdett Oxygen Co. of Texas.

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†Salt Lake City—Utah Compressed Gas Co.
†*Ogden—Utah Compressed Gas Co.

VIRGINIA
†*Norfolk— Portsmouth Oxygen Corporation.
†Portsmouth—Portsmouth Oxygen Corporation.

WASHINGTON
†*Bellingham—Washington Compressed Gas Co.
†*Everett — Washington Compressed Gas Co.
†Seattle — Washington Compressed Gas Co.
†*Tacoma — Washington Compressed Gas Co.

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†*Fond du Lac—Universal Oxygen Co.
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First to Advocate High Purity Oxygen

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Welding Wire

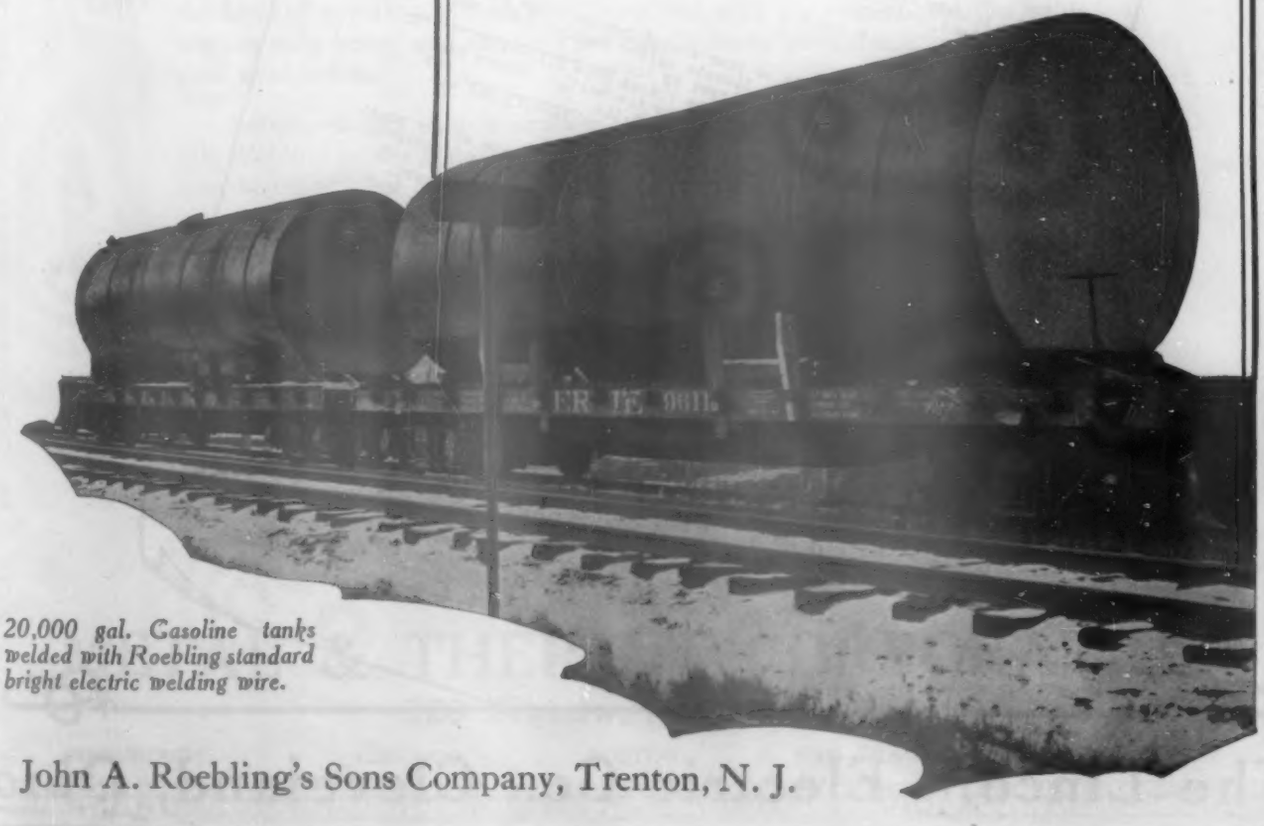
QUALITY

For work where only the highest quality of welding is acceptable, welding wire of Roebling quality is specified.

The welding qualities of Roebling wire are: first, ease of welding; second, a deposited metal that is strong, tough and durable; third, absolute uniformity.

Roebling Welding Wires conform to all standard specifications in every detail.

They produce sound welds



20,000 gal. Gasoline tanks welded with Roebling standard bright electric welding wire.

John A. Roebling's Sons Company, Trenton, N. J.

LINCOLN HONOR ROLL OPERATORS

After 10 Years

He states:

" . . . the Lincoln gives me the best results for both light and heavy work, also wonderful overhead jobs—The 'Stable-Arc' feature helps me to maintain the arc and turn out more and better work."

See Letter Below

2814 Snyder Avenue,
Philadelphia, Penna.
January 4th, 1926.

The Lincoln Electric Co.,
Cleveland, Ohio.

Attention Mr. A.P.Davis

Dear Sir:-

In reply to your recent letter, I am pleased to advise that I have used a Lincoln welder regularly for the past ten years. I was employed by the _____ Company, Philadelphia, Pa. where I used nine different Lincoln welders, and found it to be the best. Others that I used were the _____ and the _____ but always found the Lincoln was the most satisfactory and always got the best results.

I did not want to use any other make at any plant where I was employed. If the firm did not have any Lincoln's, I had them purchase Lincoln's, In two different plants, the both in Philadelphia, Pa. Company, and the _____ Company,

I am employed by the _____ Company, of Philadelphia, at the present time. They have two Lincoln's and one _____ I do not use the _____ at any time, because the Lincoln gives me the best results for both light and heavy work, also wonderful overhead jobs. The "Stable-Arc" feature helps me to maintain the arc and turn out more and better work.

At one time we had a test on the strength of welding jobs. One drum had the heads welded in by acetylene torch and another drum with the heads welded by Lincoln "Stable-Arc". The drum with the heads welded by acetylene burst at 1200# pressure, and the drum with the heads welded by the Lincoln did not budge at 2000# pressure.

I will be glad to have you send me your latest bulletin.

Yours respectfully,

William Mikrach

The Lincoln Electric Co., Cleveland, Ohio

Thermit Welding

for the

Repair of Medium and Heavy Sections

in all

Fields of Repair Work

Adaptability:—The Thermit Process lends itself to the repair of all medium and heavy sections, which means that it is available for the repair of all heavy iron and steel parts and many smaller parts.

Reliability:—Twenty-one years of practical use have shown beyond doubt that the Thermit Weld is the strongest and most durable method of effecting repairs to iron and steel sections. The failure of a Thermit Weld is so rare an occurrence that it can invariably be traced to an outside cause.

Progress:—The Thermit Process has not stood still. New and improved methods have been and are constantly being developed. Thermit itself today is far superior to the product of only a few years ago. The methods of applying it have been simplified with the results that the welds are not only better and stronger but can be made quicker and more cheaply than ever before.

Labor:—Every shop is anxious to increase the output of its force. Thermit Welding makes it possible to use labor economically and efficiently—the man-hours of labor on a Thermit Weld are lower than on any other method, and the cost of the finished weld correspondingly lower—the output higher.

Economy:—The Thermit Weld means the permanent rehabilitation of the piece to be repaired at a cost which compares favorably with any other method—and at a tremendous saving over the cost of a new part.

Proof:—The demand for Thermit in the U. S. and Canada has increased each year and our list of customers grows continuously. Wherever comparative tests have been made the Thermit Process has overwhelmingly proved its superiority over all other methods for welding heavy sections. We shall be glad to demonstrate this to your own satisfaction if you wish.

Send for Pamphlet No. 1879

METAL & THERMIT CORPORATION

120 Broadway, New York

PITTSBURGH CHICAGO BOSTON S. SAN FRANCISCO TORONTO

NATWELD

Obtainable in the following sizes:
3½" 3" 2½" 2¼"

High ratio machine cut gear and pinion movements with proper bearings add to the life of a pressure gauge and if well designed the pointer will have an accurate uniform movement.

[*"Natweld" Independent Bronze tube leakproof gauges are fitted with high ratio cut gear movements.*]

NATIONAL GAUGE & EQUIPMENT CO.

LA CROSSE, WISCONSIN

NEW YORK DETROIT CHICAGO

The Welder's Guide

In Using Norweld

Keep the white cone over the puddle, and keep the ends of the filler rod melting in the puddle, not dropping metal into it.

Let the puddle work along into new metal, not flowing over on top of white hot or cooler steel. Heat the steel as little as possible—just enough to get complete fusion.

Be sure you have a neutral flame of the right size for the thickness of the metal you are welding. Get a full sized puddle formed before trying to carry the weld along. Keep the white cone from licking the filler rod.

If the rod seems to feel sticky the puddle is probably too small. It should slide easily and be worked fairly close to the line of the weld. Too much white hot metal in front of the puddle will reduce the chilling effect of the parent metal and the resulting weld metal will be coarser in structure than it should be.

When welding is interrupted, remove flame from puddle slowly. When it is resumed make puddle include back edge of last ripple.

A Practical Book on Welding
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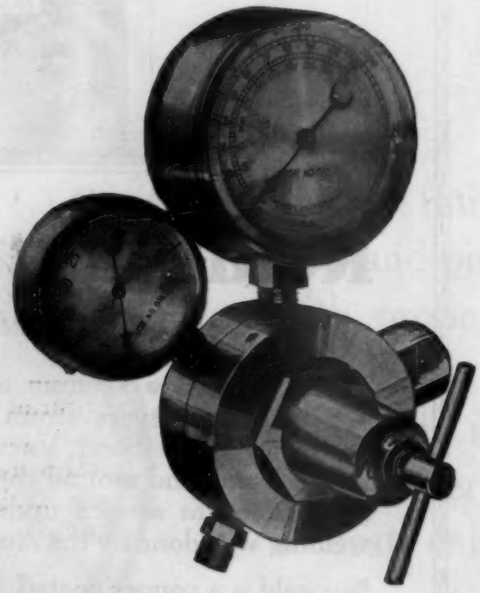

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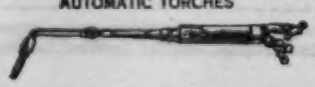
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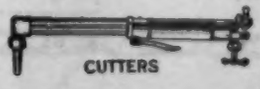
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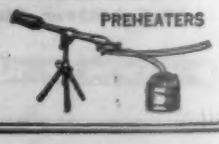
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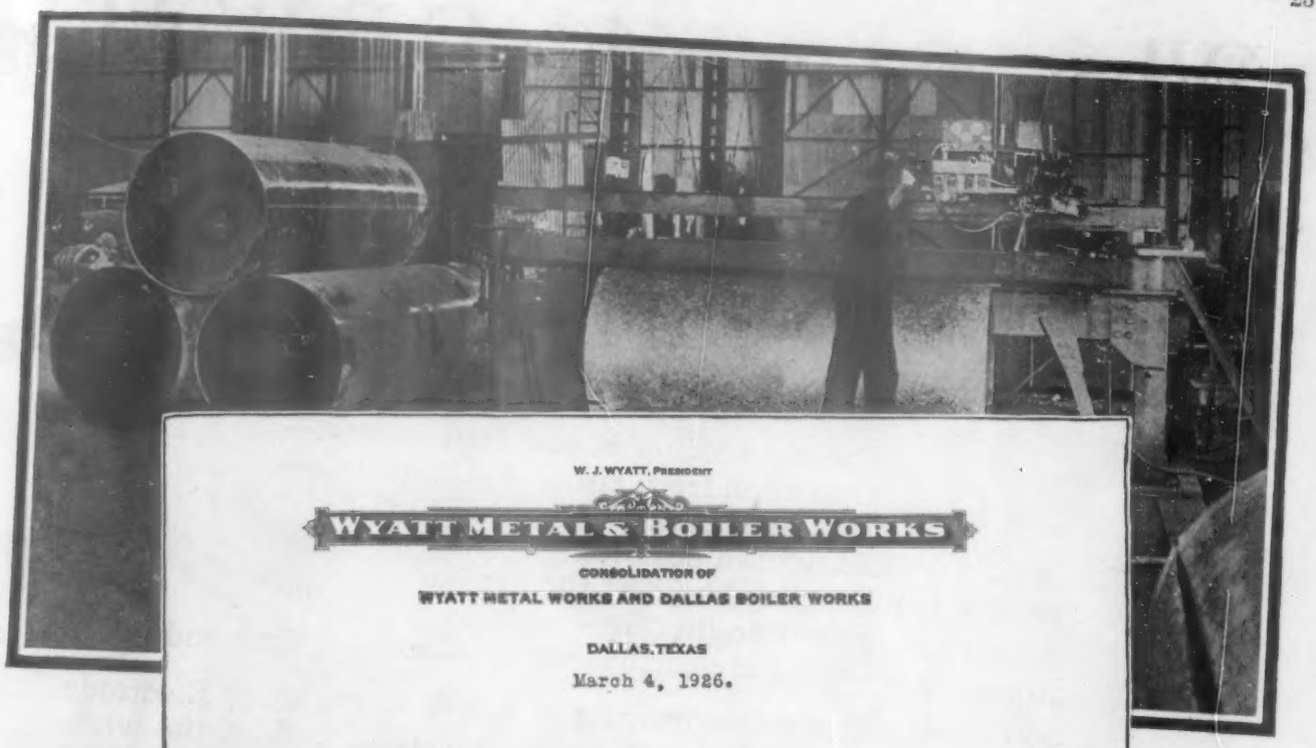

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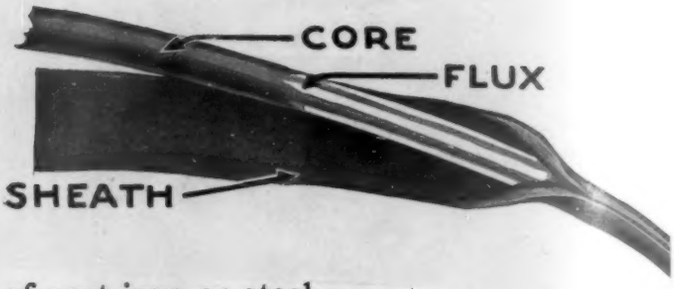

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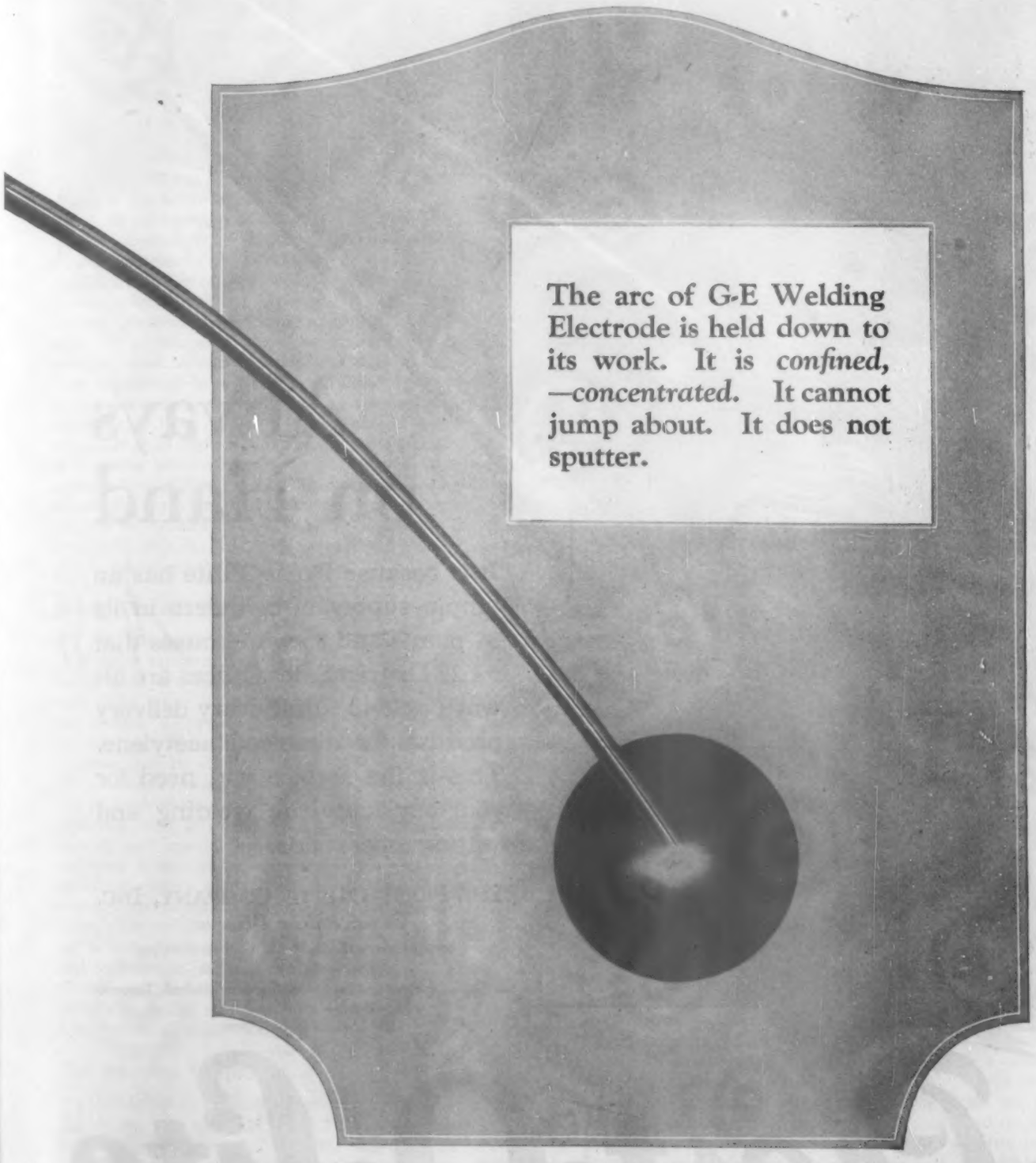

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EDITORIAL

To Show the History of Welding

A PERMANENT exposition of American achievement in the peaceful arts has been made possible through a bequest of the late Henry R. Towne. In making this bequest, the hope was expressed that it might initiate a movement which should become the nucleus of a greater endowment to which public-spirited citizens might contribute as long as the industrial arts flourished in this country. The suggestion was made that the first unit be devoted to machine tools, an industry in which this country is the acknowledged leader, for these constitute a chief part of the equipment of many other industries and are the means whereby all other industries are produced. Following this suggestion, the trustees of the Museum of the Peaceful Arts are organizing a machine tool section covering the field in three divisions. In the second division, welding equipment, cutting equipment, brazing and soldering equipment are indicated in one class. It is desired to show the history of each type from primitive forms through the significant stage to the latest forms. Since suggestions have been invited which might help in the development and the realization of the complete plan, it is likely that many of those who have been connected with the welding industry from its beginnings can be of real service to this museum by furnishing information, photographs, drawings and descriptions of equipment and shop practices which may be available. Further information regarding the requirements and desires of the trustees may be obtained by writing to the Museum of the Peaceful Arts, 29 W. 39th St., New York City., to whom all correspondence on this subject should be addressed.

Next—The All-Welded Home

WHILE oxy-acetylene welders and electric welders have been using research methods to establish the dependability of welded joint in structural steel, there has been some effective work going on in another group which promises to result in a vast increase in the demand for this kind of welding, when its efficiency and economy have been definitely recognized. The American Institute of Steel Construction is conducting an extensive educational campaign to develop a demand for structural steel in residential construction. Steel is recommended as a substitute for wood in framework and floor construction. Its practicability and superior advantages are being widely advertised and there is promise of further technical research and further educational work. Some of the mills have already completed arrangements to roll light shapes to meet the demand of the future. Enough has already been learned of the value of welding to satisfy many of us that this move toward the use of steel in home building means the opening up of a new market of immense proportions. It it not too early to predict that within a reasonable time the industry may expect to see published a story of an all welded home.

The Business Outlook

BOOKINGS of fabricated steel plate for the first four months of this year amounted to 118,385 tons as compared to 76,251 tons in the same period of 1924 and 92,801 for the same period of 1925, according to reports from thirty-six firms received by the Department of Commerce. The major portion of this tonnage was consumed in the manufacture of oil storage tanks, refinery materials and equipment, tank cars, gas holders, blast furnaces and stacks, all of which are recognized as regular customers of the welding industry. While these are not welding statistics, the figures show how decidedly the field of usefulness for welding processes is expanding in a single direction. It is apparent that the demand for welding equipment and supplies is growing larger because the industries which are learning to depend upon welding are themselves growing larger.

A Victory for the Torch

NEWS has recently been broadcasted through the industrial and business press of a remarkably successful series of tests of gas welded steel structures. This preliminary report is necessarily limited in details, but the important fact is that welded structures of one or two classes have been proven to be of sound construction, far more than equal to the service required of them. The industry can afford to wait a bit for accurate cost data. It is a safe bet that they will show savings over riveted construction. The greater simplicity of welded joint design makes this practically certain. Through these tests, a definite step has been taken toward the creation of a vast new field of usefulness for the torch. A particularly interesting phase of this work is the substitution of tubular members for cenventional structural steel shapes. There are big possibilities suggested for economy in material. Altogether, it appears that the torch has given the rivet another licking, and prospects are very good that the victory can be followed to good advantage.

Welding Jobs for Welding Contractors

A WELDING contractor recently made the remark that he had hundreds of people working for him to whom he did not have to pay salaries. The idea behind this was that in hundreds of different kinds of factories and industrial plants throughout the country new applications of the welding process were being developed all the time. New methods of doing old jobs make them more profitable or more easily guaranteed, and new uses for old methods suggest more ways to keep the welders busy. This chap thinks that he knows the operating principles of welding pretty thoroughly, and his success as a contract welder would indicate that he isn't unduly enthusiastic about his own work. What he is after is ideas that will keep the shop busy, and every time he sees a new type of a job described he scouts around to find a customer for that kind of work. Men like this are making a real industry of job and contract welding.

Rubber Tires for Portable Outfits

PORTABLE oxy-acetylene welding equipments which are rolled around on smooth floors do not give the user any more trouble than stationary outfits, but in cases where the truck must be pushed around over rough places and across tracks it does not take long for the excessive shaking-up to jar the outfit out of adjustment, causing troubles which are in no way due to the apparatus itself. A recent item in a railway journal tells how one street railway welding department overcame this condition by mounting trucks for portable outfits on second-hand Ford front wheels, using old tires. This is said to have made a considerable difference in the operation of the equipment. Similar use of a pneumatic tired truck has been made by one of the arc welding manufacturers, a portable arc welder being mounted on standard Ford wheels with pneumatic tires. A welder who had had considerable experience with this particular type of machine mentioned the ease with which it could be taken into office buildings and hotels when it was necessary to make repairs inside of buildings. This machine mounted in this way could be moved around inside of the buildings almost noiselessly, in spite of its weight and bulk. This feature allowed some very interesting jobs to be done so quietly that the presence of welding equipment in the building was entirely unnoticed.

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LINDE OXYGEN

Building an Industry With Service

The Aim of the Service Organization Has Been to Demonstrate and Instruct—Welding as a Real Business Has Grown Through Their Efforts

"I'M off you for life, Bill. You welded a job over at the United plant that I would have got if you had let it alone." This, with a few cuss words missing, was spoken to a service man by a job welder who had been after the business of the "United" plant. "Don't think I hurt you a bit, Charlie," said the service man. "Maybe I helped you. Time will tell. Well, so long!" and he was on his way.

Several months later Bill and Charlie met again and the welder seemed to be not in a bad humor, so Bill asked him, "Well, do you still think I'm hurting your business?" "Not by a long shot," replied the welder. "You showed them it could be done, now I'm doing a lot of it for them. More power to you, Bill."

Ever since the beginning of the welding industry the service man has had a definite place in the program. His mission has been misunderstood in many cases, particularly by the customer receiving the service, perhaps misrepresented in many cases, and certainly taken advantage of in a number of cases; but his work has always been a necessity; and through the changes time has worked in the development of the process and its applications he has continued to function to the best of his ability and to make his work count for as much as possible toward increasing the market for apparatus and materials manufactured by his employers. The incident related in the introduction to this article is probably typical of many similar experiences which practically every service man could relate. It is one of the cases where the service man can be misunderstood.

Right along with the industry which concerns itself with the production of welding apparatus another industry has been developed which is engaged in the use of that apparatus. There is naturally a limit to the number of concerns who can profitably engage in the manufacture of equipment, but lots of men in the industry consider that if there is any limit to the demand for good job welding shops and first class welding contractors, the limit has not yet come into sight. There are probably thousands of shops equipped to handle ordinary repair work, but only a small percentage of them can put real engineering ability behind their efforts. Consequently it is easy to see possibilities of great progress in the job welding business itself.

Service rendered by gas or apparatus manufacturers is bound to have an influence on the development of this industry called "job welding" or "contract welding." A survey of the development of the service idea may serve to throw a little light on the question as to just what sort of an influence this will probably be.

When welding torches were first put on the market, it is safe to say nobody knew how to use them. Even the manufacturers themselves were unaware of their full possibilities and unprepared to demonstrate their full field of usefulness. This situation then was that nobody wanted a welding torch. Nobody knew what it would do and nobody knew how to do it. Demonstrations were necessary for practically all of the initial sales and a service man in those days had a heavy job. At the same time the fundamentals of the process had to be gone over so many times that there was undoubtedly a good deal of routine in his program.

At that time, also, there were no job welding shops. Some of the manufacturers therefore established job welding shops in the different cities, which were mainly for the purpose of demonstrating that different classes of work could be done, but in which, nevertheless, an attempt was made to make a profit on the operation of the shop. The man who was responsible for the shop certainly had his troubles in this last respect, because no sooner would he get a customer convinced that welding could save money for him than a salesman would be on the trail of that particular customer to sell him the apparatus to do the work himself.

While all of this missionary work was going on the service man was prepared to do almost anything. The thought behind it was always to secure more recognition for welding in order that the demand for apparatus might be increased.

As this recognition was secured, the nature of the service rendered has undergone some definite changes. The original need for a welding shop operated by an apparatus manufacturer has practically ceased to exist. This is because every kind of advertising and selling effort has been brought to bear upon the industrial world with such effect that the value of the process is universally known. The welding torch is no longer a novelty. It is recognized as a necessity in every industrial plant and the market is highly competitive.

The educational work of the manufacturers has been most effective in showing the value of the oxy-acetylene process. There are two other subjects concerning the process which still require personal attention. One of them is the maintenance of apparatus and the other is the possibility of finding more use for it. Consequently the service which the manufacturer is most actively supplying to the user of apparatus can usually be put in one of two classifications. One of these is the care and repair of equipment and the other is engineering service which broadens the field of usefulness of the process.

As long as welding apparatus is used it will probably be necessary to follow up sales by periodical inspection to make sure that every piece of equipment is kept in good working condition at all times. Millions of dollars have been spent in the development of the oxy-acetylene process to its present state of perfection, and maintenance service on equipment is only a logical form of insurance against dissatisfaction which would result if some interest was not taken in the matter of keeping things in first class condition.

It is the other sort of service which bothered the welder, mentioned at the beginning of this article. Probably his misunderstanding of the situation arose from his impression that this service is given free. As a matter of fact no such service can be given free. There is a charge for it included in the price of the apparatus. Back of the service man there is another sort of activity which also has to be paid for when the apparatus is purchased. There is expensive laboratory research work devoted to the solution of welding problems, which often look impossible and which cost hundreds of dollars to solve, but which may save thousands of dollars to industrial plants when the right solution is finally found.

This kind of service cannot be supplied on a large enough scale to work any kind of permanent injury to the job welding fraternity. No manufacturer can afford to supply regularly without charge an experienced welder to take work away from the local job welding shop. Service of this sort is generally understood to have for its purpose a demonstration that a particular kind of work can be done. The service man is kept on the staff to show what can be done and to show how to do it, and many a job welder can tell from his own experience how useful such service is to the welding shop in emergencies. He is not there to do the job himself and does not usually want to waste time on work which does not present particular difficulties. In other words, he is primarily an instructor rather than a welder, and is often definitely instructed to preserve that status. The fact that customers receiving the service persist in disregarding this necessary distinction often presents difficulties. Then the manager has to use his head.

The theory behind the type of service which is rendered today by apparatus and oxygen manufacturers is that by showing that a job can be done and then showing how to do it, the way is paved

for increased sales of apparatus and welding gases. It is very apparent that the idea behind the service is fundamentally the same as it was in the beginning of the welding industry, although the nature of the service itself has changed to a large degree on account of the fact that more people are familair with the fundamentals of the application of the process. There is also a noticeable trend on the part of gas manufacturers to carry on the engineering, or application service. And, as in the apparatus manufacturer's case, they want the men who do it to act always as instructors rather than welders.

One of the more recent phases of service consists in making surveys of large industrial plants where some welding is already being done, to find out how many additional uses for welding could be found in sufficient volume to justify installation and operation of additional equipment. It is not unreasonable to suppose that a number of surveys of this kind would disclose a possibility of quite a volume of welding which plants might prefer to turn over to a local welding shop rather than attempt to do it themselves, either because it was of an occasional character or because the welders in the plant were trained for specialized applications and would presumably not be able to handle work as well as it could be handled by an organization trained and equipped for general repair work.

The leading welding shops are already accustomed to receiving jobs of this nature. All of them have a good number of customers who own and operate their own welding equipment, but nevertheless turn over a steady volume of work to the job welder when they find that he can do a satisfactory job at a fair charge. These jobs are usually profitable, not only because of the size of the contracts, but also because the customers are well financed concerns who pay their bills promptly.

These are some of the indirect ways in which service work is not only increasing the field of operations for the welding shop but also may possibly be sending new business right to his door. There is a direct value in service work to the job welder, in that the service department is always at his disposal to help in the solution of unusual problems and to contribute in every possible way toward the success of his work. Everybody wants to see good welding done and to keep down the possibility of the kind of failures which would produce dissatisfaction with the process.

As an industry the business of repair welding and contract welding has made steady progress from the beginning. There are scores of splendidly equipped plants in the important industrial centers and they are saving millions of dollars for their customers by putting additional service into plant equipment which would otherwise be discarded as hopelessly broken or worn out. The growth of this industry has been greatly encouraged and supported by field and printed service which apparatus manufacturers have been able to give. The welding industry has, as a whole, profited considerably from the work of the service operators and it is only occasionally that proper credit has been given to their splendid efforts. More power to them!

R. K. RANDALL MADE DIRECTOR OF THE CLEVELAND Y. M. C. A. SCHOOL OF TECHNOLOGY

On May 24th R. K. Randall, who has been in the charge of the welding instruction in the Cleveland Y. M. C. A. School of Technology, resumed entire charge of the trade schools, including battery, ignition, machine shop operation, auto mechanics and electric and oxy-acetylene welding. As a result of the increased responsibility coming from this promotion Mr. Randall's activities in the future will be that of educational director rather than teacher. His work with the welding department of the school has attracted a great deal of attention on the part of the welding industry throughout the country, but it has been particularly appreciated in the city of Cleveland, where there is always a demand for well trained operators. His close study of the needs of employers and his conscientious work to provide properly trained men for the work to be done has given his school an unusually high standing. Under his direction the department has steadily increased and while building that up Mr. Randall has given generously of his time to the activities of the American Welding Society and has been of considerable service to the welding industry by contributing articles on the subject to the trade press and to the newspapers, by cooperating with the local trade unions who desired to become better posted on the possibilities of welding for their work, by reading papers before engineering bodies, and lending a helping hand whenever there was an opportunity to do something in the cause of welding. In spite of the fact that his new position means additional activity Mr. Randall states that his interest in welding will not be affected in any way, as he has been too long in it to forget the fascination of the work itself.

BOILER MAKERS MAKE PROGRESS IN WELDING STANDARDS

At the 1925 meeting of the Master Boiler Makers' Association, which was held in Chicago, the report of the committee on autogenous welding as applied to steam pressure boilers was distributed among the members present and definite action taken on each section of their report, which included a careful compilation of proposed standards to govern welding practices. A considerable portion of that report was approved without amendment, some of it was amended and approved, some sections were stricken out entirely and some of it was referred to a standing committee for further study. This committee reported at the 1926 convention, which was held at the Hotel Statler, Buffalo, New York, May 25-26-27-28, with further recommendations regarding the sections which had been referred to them. These recommendations were discussed in order and most of them approved or amended and approved. This is a very significant piece of work and provides the association with definite standards of practice on important work. The meeting this year was well attended, the various committees having to do with the arrangements for the convention having done their work faithfully and provided a splendid program. In the exhibits of the Boiler Makers' Supply Men's Association the welding industry was represented by the Air Reduction Sales Company, New York, Chicago Eye Shield Company, Oxweld Railroad Service Company, Chicago, John A. Roebling's Sons Company, Chicago, Thompson Electric Welding Company, Lynn, Massachusetts, Torchweld Equipment Company, Chicago, and The Welding Engineer Publishing Company, Chicago.

C. G. M. A. INVESTIGATING COMPRESSIBILITY OF OXYGEN

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The Compressed Gas Manufacturers Association is expected to complete soon investigations on the compressibility of oxygen and to establish the proper capacity limits of cylinders designed to deliver a given quantity of gas.

Work on the standardization of valve threads has also progressed and it is expected that a proposed standard for oxygen outlet valve threads and connecting pieces will be ready for distribution soon.

CLEVELAND DISTRIBUTORS FOR LINCOLN

With the naming of the Cleveland Tool and Supply Company, Cleveland, as a local distributor, the Lincoln Electric Company is, for the first time being represented at home. The local concern which has taken on the full line of Lincoln motors and welders, have been incorporated since 1897, at which time they began business with 20,000 dollars and in a space fifty feet square. The firm's present location, consisting of a four-story and basement building supplying 60,000 square feet of floor space is situated at West Sixth Street. Officers of the company are C. C. Coventry, President and Treasurer; F. C. Wittich, Vice-President; Charles C. Wright, Secretary. In addition to a large surplus, the company has a paid up capital of 400,000 dollars. The firm is engaged in the sale of machine tools, seamless steel tubing and general factory and mill supplies.

Research in the Welding Industry

The Man On the Job Outnumbers the Man in the Laboratory by the Thousands and Has Corresponding Opportunity to Make Welding Pay Him More

By R. E. Kinkead

OLD POPS McGREW probably knew as much about the fundamentals of how to get results with research as any man I ever knew. However, if anyone would have suggested to him that he ought to establish a research laboratory and hire some well equipped scientists to man it, the old man would undoubtedly have thrown an apoplectic fit.

A bright young fellow had sold Pops a plate and structural shop down in Eastern Ohio for the reason that Pops had a string of plants which had been buying a lot of fabricated steel and tanks at what he believed to be fancy prices.

About a month after he had formally taken over the shop, I got a wire from him which read as follows: "MEET ME AT BLACKWELL SHOP NEXT WEDNESDAY MORNING." (Signed) D. W. McGrew.

"Find the Best Way of Doing the Work—The One That Saves Labor and Material."

I got the wire on Thursday morning and on Friday morning, I hired out as a welding operator at the Blackwell Shop. Having sold Pops some thirty thousand dollars worth of welding equipment, I knew something about him. He had never asked me the price of anything I had ever sold him, but he could ask more pertinent questions about conditions in his plants, than you would think possible for a man nearly seventy years old.

Well, the next Wednesday morning at about ten o'clock the old man came thru the shop with his "gang," which included the General Manager, the Superintendent, Plate Shop Foreman and a couple of engineers. He walked over to where I was working and said, "Come on along, Son."

So far as anyone could tell, he was no more surprised to see me there in working clothes than if I had told him what I intended to do.

Without going into the details of the problem that plant had,—and they were many, as well as serious—I may say that we had a session in the office that left everyone pretty limp and done in at five o'clock in the afternoon, particularly so since lunch time was entirely lost sight of in the struggle.

Briefly, the difficulty was this—the shop cost on certain plate and angle construction, of which the McGrew plants required large quantities, was running $40.00 a ton. Pops had been buying the stuff in the open market, for material plus $38.00 a ton f. o. b. Pittsburgh, and here he had a plant of his own which apparently could not fabricate it as cheaply as he could buy it on the outside. From the Superintendent down, the shop men all knew about welding but it apparently had never occurred to any of them that it was good for anything but plugging mispunched holes.

I knew of an installation of welding equipment we had in Chicago doing substantially the same work at slightly under $20.00 a ton, and testified that the maximum cost of doing the work would not exceed $22.00 a ton, during the first three months. In addition we could cut the weight of material about 15 per cent.

Pops kept them at it for more than four hours. If the discussion lagged, he would start asking questions and away they would go again. Finally he started to talk to those fellows, and when he finished, tired as they were, I think if someone had started it they would have yelled themselves hoarse proclaiming to the world that that outfit had the best Boss in the world and that all Hell couldn't stop them from running the competition in that part of the country out of business.

I wish I could repeat exactly what he said, but even tho I could write down exactly what he said, no one but Old Pops could say it the way it was said. Substantially it was this—

"There is very little about the mechanical details of running this shop you gentlemen have not discussed here today. However, you have not reached any definite conclusions as to what you ought to do. You have given me plenty of opportunities to tell you what I want you to do, but if you will reflect a moment, you will recall that I have not availed myself of any of them. If you can forget for a moment that I am the owner of this plant, I would like to talk to you merely as an old man.

"If you gentlemen make a success of this plant, it of course will increase my wealth. Such increase in wealth will be about as useful to me as if you were to increase the length of my coat tails by say four inches. On the other hand, gentlemen, if you make this plant successful, you personally each shall become successful. And I mean that it will bring you not only financial success, but what is tremendously more

important, personal and satisfying success.

"Your business is an old established one and it is clouded with traditional ways of doing things. If you wish to be certain of reaping the deadening sorrow of feeling that your work for me is futile and of little consequence in the world, follow the traditions of your business. This plant and this business has become standardized—it was standardized twenty years ago, yes, fifty years ago. Most of your competitors do things in exactly the same way you have been doing them. So long as you all go at the job in the same way, the maximum variation in shop cost over any considerable length of time will not amount to as much as fifteen per cent. That is not enough margin, for either financial or personal success.

"There are better ways of doing things than you are using in this shop today. Find them. The common interest of humanity demands that you turn out a better product at a smaller expenditure of material and labor. Your self-respect will demand that you shall not fail.

"It is not within my power to be of great assistance to you. If you will reflect a moment, you will see that even tho I own this plant outright, I do not set the price we pay for material, or labor, or shop tools, nor in fact do I have any real control over the salaries you are paid. If I reduce salaries and wages, I lose good men. If I raise them materially, someone else will soon own the plant and he will have to cut expenditures or fail.

"May I commend to you, gentlemen, the thought that the power to success in this business is within you. Tradition and custom makes monkeys of us all. Cut the bonds which have been holding you to the blind worship of methods which were right fifty years ago. Find the best way of doing the work—the the one that saves labor and material—and that method will become the pattern for smaller souls to follow. Do not fear being radical—fear only being wrong. Start over again, if necessary, and find out WHY you do things thus and so. If you will be absolutely honest with yourselves, you will serve the interests of this business and of humanity at large.

"Now, gentlemen, don't bother me with details for sixty days. If you need equipment, order it. If you need men, hire them. If you are going to change the design or appearance of any of the stuff you make for our other plants, don't look to me to make them like it. If you cannot sell the idea to our own crowd, sell it to their competitors, and you will have our people eating out of your hands before you know it.

"I wish I were young enough to be with you in this struggle, but for me the twilight has begun to fade and I am in the evening of life. If your hearts are right and you think straight, great success lies ahead of you."

Pops McGrew left on the six o'clock train, but his great understanding soul was with those fellows thru the struggle, and is with them now, altho Pops has been dead more than two years. Within six months they were turning out the material which had a shop cost of $40.00 a ton, for a little under $15.00 a ton, and were building welded steel construction for several new customers. Today the Superintendent is Vice President and General Manager of a very large plant in an entirely different line of business.

From five decades of successful living, D. W. McGrew had learned the secret of getting results from research. He knew how to get the Motive Power back of it. In all the years, I knew him, I never heard him enthuse about how much money he expected to make out of some pet scheme he was working on, but I have heard him say time and time again—"Shake a leg, Boys, shake a leg, this is God Almighty's business,—and He wants the job done."

Research for the sake of research has produced an infinitesimal part of the world's progress. Research on the part of the common man with the motive of supplying people with better things which cost less has set the world forward at an amazing speed in the last hundred years. So long as scientific research was exclusively a scholarly pursuit, as it was up to and including the middle ages, no one got very far. With the coming of Democracy, and the education of the masses, came the awakening of millions of minds to the possibilities of service to humanity thru the application of scientific thought.

The great progress in gas welding and cutting has been made since thousands of common men have learned to handle the torch. The chemistry of oxidation was known in laboratories for many years before it became a necessary and useful process in industry. Electrical energy as a source of heat for fusing metals was known in laboratories for twenty years before it became a means of producing things that people want at less labor and material cost. No successful research man ever tore out hands full of hair to discover either gas welding or electric welding. Grimy engineers, welding demonstrators and operators the world over, have conducted the research, on the job, that has made cutting and welding the fundamental processes on which the metal working industries will create a new age of welded steel. Industrial scientific research is a democratic activity. Great forward steps in the discovery and application of scientific facts come in volume from common men who are enthused with the adventure of living.

We are easily overwhelmed and become hero worshippers when a man brings forth a new fact, a new and better tool, an obviously better method or process. We say, "Put him in a laboratory. He is Nature's chosen instrument for the revelation of her secrets." But alas, his genius deserts him in the laboratory and Nature speaks no more. Nature is a firm but loving mother, who reveals her wisdom to her sons who can make a commonplace job a thrilling adventure.

My favorite newspaper doctor recently told in his daily column the story of antiseptics and modern asceptic surgery, and there was a lesson in it for the welding industry. Great, elaborate and institutionalized research was carried on to develop an antiseptic which would kill the germs in live tissue. Men have spent their lives trying to find out all there was to be known about killing germs in the human body. But some simple soul came forward with the idea that the right procedure was to prevent the germs from getting into surgical lesions. Today the marvels of modern surgery rest on that simple idea. Here were great bodies of scientfic explorers who could call a strange germ by its first name on sight, who were searching and researching for facts, yet the master craftsman of surgery solved the problem while at the daily struggle against disease and death in their hospitals.

We, in the welding industry, are a good bit like the British House of Commons during the war. Things were going wrong—no one knew much of anything for certain about what was actually going on. Finally, after days of wrangling about the facts, an obscure member got to his feet and said—"We are not getting anywhere with this discussion. LET'S GET ON WITH THE WAR."

It is an easy matter to blunder along trying to find out all the facts about oxides and nitrides, about critical heat lines, about the effect of the human factor in welding, about expansion and contraction in automatic welding, etc., but, "Let's get on with the war." We learn the answers to those problems in the heat of battle trying to do useful jobs.

We have a mighty fine salesman, whom I will call Bill Jones, because that is not his name. Talk to Bill for thirty minutes and you feel that you are a mighty intelligent individual. You forget about Bill and renew your faith in yourself. That is Bill's art and I don't know how he does it, but I like him and so does everyone else.

Now Bill had a very important prospect some years ago who wanted to do a lot of arc welding, but he was afraid of it because the weld had no ductility—it wouldn't bend. This concern spent a lot of money trying to find out what made welds lack ductiljty and trying to overcome it. They searched and researched for the answer. Finally Bill wrote me to come

(Continued on page 50)

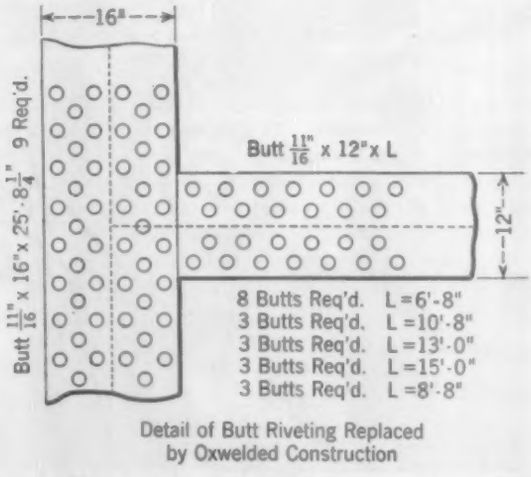
Design of Oxwelded Equipment*

Only When Joints Are Completely Designed for Welding Is It Possible to Get All of the Advantages Offered by the Welding Process

By E. E. Thum†

IT SHOULD not require much argument to convince one that it would be lazy engineering to take a design developed by experience for one type of construction and expect the best results when applied to a radically different type. For example, where western railroads pass through heavily timbered country, wooden trusses are frequently used for spanning small gullies. Wooden truss design is characteristic of the nature of the material used—it is no slavish copy of the steel trusses used elsewhere on the same lines. Again, reinforced concrete buildings are not made from designs intended for steel skeletons; a knowledge of stress distribution in beams, slabs and columns will be used to distribute properly the steel for tension and the concrete for compression. In the same manner, an engineer would not be satisfied to take a design for a riveted truss and merely note on the drawing: "Substitute welding for riveting" and expect to get satisfaction, or the greatest economies.

Definite proof of this general position (if proof be needed) is now available.



Detail of Butt Riveting Replaced by Oxwelded Construction

Fig. 1. A Riveted Butt Strap Joint Formerly Used in Assembling Riveted Kilns.

A modern lime-burning plant was placed in operation late in 1923. It contained three huge kilns, each 125 feet long and 8 feet in diameter. Two were riveted and the third oxwelded.

Riveted kilns of this size have usually been made of 5/8 in. plate, with butt strap joints; double riveted on longitudinal seams and triple riveted on circumferential seams, as indicated in Fig. 1. A theoretical analysis of the stresses of such a kiln when in operation under full load indicates that the greatest forces existing in the steel plate are about 4700 lb. per square inch, which is only 30 per cent of the safe design load for structural steel in buildings. Undoubtedly the metal in such a design is not working to anywhere near its capacity, but since experience indicates that riveted kilns should be made of 5/8 in. plate, the welded kiln was also made of the same thickness. The joint, however, is extremely simple. Contrast Figure 2 to Figure 1.

**A paper read before the American Welding Society, New York, April 22, 1926.*

†The Linde Air Products Company.

After two years' successful operation, and in order to determine if possible the reason for such a large excess of metal required in the shell, T. W. Green of The Linde Air Products Company made a series of determinations of the stresses existing in the steel plates. This investigation was made by means of an extensometer, a precise gauge for measuring small changes of length in metal as the loading is applied or relieved.

Figure 3 shows a diagram of the results of tests on the oxwelded kiln running empty. (The vertical scale of the sketch has been much magnified, so the kiln appears to be several times as large in diameter in comparison to its length as it actually is.) The horizontal straight line 0-0 represents no stress, and the distance from this line vertically to the curved line represents the amount of stress in the shell at the corresponding distance from the end. It will at once be recognized that the kiln acts as a long beam, overhanging its two supports. At the very ends the bending stress will be zero; the stress in the steel gradually increases to a maximum at the supports. From the supports toward the center, the compressive stress (in the bottom, for instance) quickly decreases and reverses its direction, and at the center of the span increases to a maximum tension. Stresses in the top of

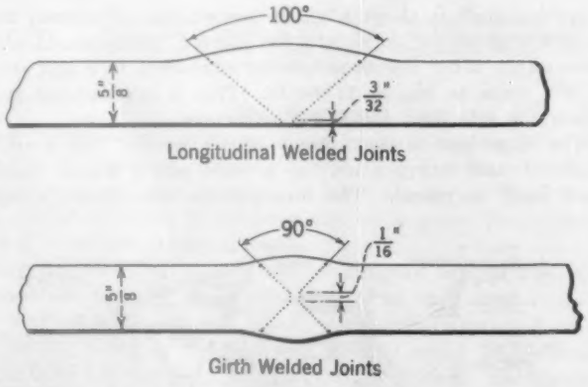


Fig. 2. Single and Double Vee Types of Welded Joints Used in the Welded Kiln.

the shell, of course, are exactly opposite, tension where the diagram shows compression, and vice versa. As the kiln rotates, these stresses continually change; what was once at the top of the shell soon becomes the very bottom, and then back again, reversing the loading at every rotation. Such continually changing load is most severe service to withstand.

It was estimated that the shell plus the lining, empty, weighs 360,000 lb. Despite this enormous weight, the maximum stress in the shell (at the center of the span and at the upper support) is computed to be 3000 lb. per sq. in. A series of actual extensometer measurements, plotted in the dotted line in the diagram, shows that the theoretical values are only a trifle too high.

Measurements made across the joints in the welded kiln showed no undue movement. In other words, the oxwelded joint acted as a homogeneous portion of the shell. Similar measurements across triple-riveted butt straps in the riveted kilns, however, showed movements from 2 to 2 1-3 times the amount existing in the plates immediately alongside. This excess movement is undoubtedly due to a slipping of the sheets, in and out, in and out, every time the kiln rolls over.

It cannot be laid to poor and loose riveting, as the work was done in a modern shop with hydraulic machinery, under the closest supervision and inspection. It is undoubtedly an inherent action in a riveted joint, observed in hundreds of other structures, where unequal distribution of alternate loading on the rivets causes progressive loosening of the joints. Users of riveted kilns expect to shut down before many years, rip out the lining, and redrive a lot of loose rivets. This need never be expected in a welded construction.

The maximum possible loading is shown in Fig. 4, when a heavy collar of material has sintered against the shell near the hot end. Even under these conditions the maximum stress in

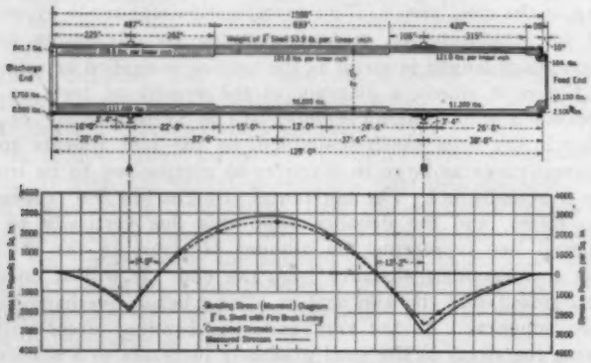


Fig. 3. Diagram of the Results of Tests on the Oxwelded Kiln Running Empty.

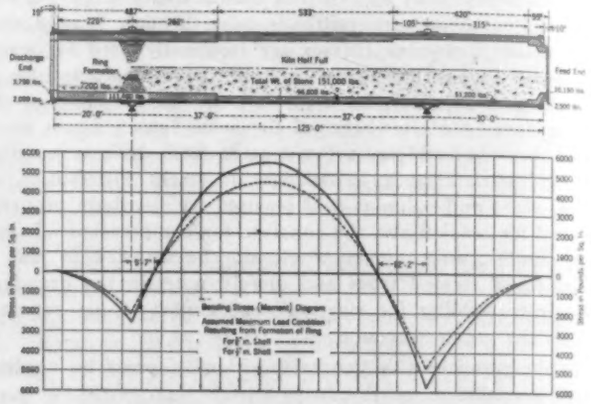


Fig. 4. Diagram Showing the Results of Tests Upon the Oxwelded Kiln Running at Maximum Possible Load When a Heavy Collar of Material Has Sintered Against the Shell Near the Hot End.

a welded shell is about 4,700 lb. per sq. in. However, after only 2½ years of operation, the riveted joints would show movements under the same loading equivalent to a unit stress of 2⅓ times as big, or 11,000 lb. This is approaching much closer the safe limit for a steel structure.

The investigation thus shows why a riveted kiln must be made of such heavy plate. If it were not it would quickly work itself to pieces. The investigation also shows another

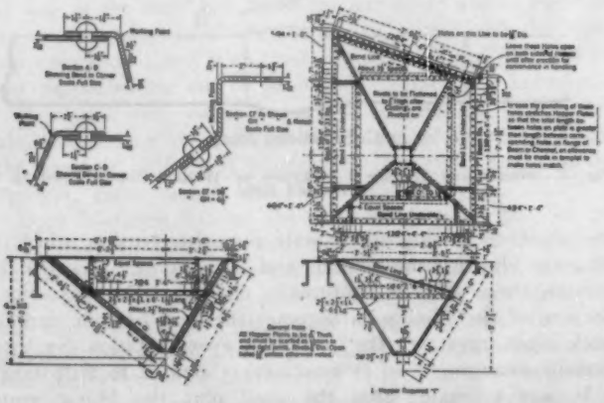


Fig. 5. Detailed Drawing of a Riveted Skew Hopper. This Hopper was One of a Large Number of Similar Special Details for a Dust Collecting System.

important fact not known three years ago. That is, that there is no reason why a welded shell should be as thick as a riveted shell. Large savings thus are possible.

For instance, the dotted line in Fig. 4 indicates that the maximum possible stress in a welded kiln of this size made of ½ inch plate would be only 5,600 lb. per square inch (Certainly a modest value). For this loading, seldom if even reached, the factor of safety is 6.4, based on the elastic limit, or 8, based on the ultimate strength after allowing a joint efficiency of 80 per cent. These factors will appeal to designers as extremely conservative. Maximum shearing stresses do not exceed 1,100 lb. per sq. in.; temperatures never run much more than 400 deg. F., and dynamic stresses are negligible.

It is obvious that by reducing the shell thickness from ⅝ to ½ inch, a very marked saving can be effected, thus reducing the cost far below the riveted construction. In addition to saving 8 tons of steel, there would be a material saving in bending, handling, freight, and erection. Furthermore, the actual cost of welding would be at least 1-3 less, as the cost decreases very rapidly with decrease in plate thickness.

Savings in Drawing Room Expense

One item in welded design which is seldom appreciated is the saving in drawing room expense—in the time of draftsmen, tracers and checkers. This is immediately apparent in a comparison of Figs. 5 and 6.

Figure 5 shows a skew hopper, one of a large number of similar special details for a dust collecting system. The riveted design involves accurate location and dimensioning of about 100 open holes for the hopper, and an equal number on the detailed drawings of the supporting beams. One such drawing requires a total of about four days to compute, draw, trace and check.

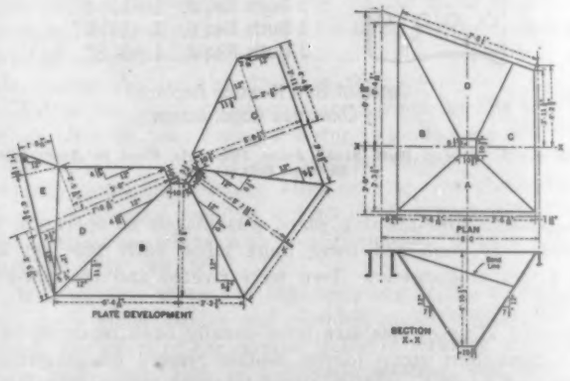


Fig. 6. Drawing Showing the Same Skew Hopper Shown in Fig. 5, But Detailed for Welding. Note the Simplicity of This Drawing as Compared with Fig. 5.

Contrast the simplicity of Fig. 6, the same hopper designed for welding. Joints would probably be at the corners; the top edge will also be welded to the supporting beam flange. It is only necessary to develop each plate, show its true dimensions, locate any necessary bend lines, and the drawing is done. Less than half the time is required in the drawing room.

This advantage is multiplied when the work gets into the shop. Fig. 6, the welded design, merely requires reproduction to scale on the metal. If sheets are too small, corners are

welded on where necessary. Reentrant angles are easily cut with the blowpipe. The riveted design, however, requires considerable more "drawing" by a layout man of high ability. He must develop the true size of every sheet he cuts, make proper allowance for all the flanging, make careful note of all working points, and locate every rivet accurately on two (sometimes three) different pieces of metal. These various shop allowances are often treated as private property and the draftsman does not have the information necessary to draw templates for riveted work. In welded design, however, it is advantageous to indicate the cuts and bends on the drawing so as to have minimum waste and minimum welding, at the same time conforming to the available sizes of sheets and the possibilities of the bending equipment.

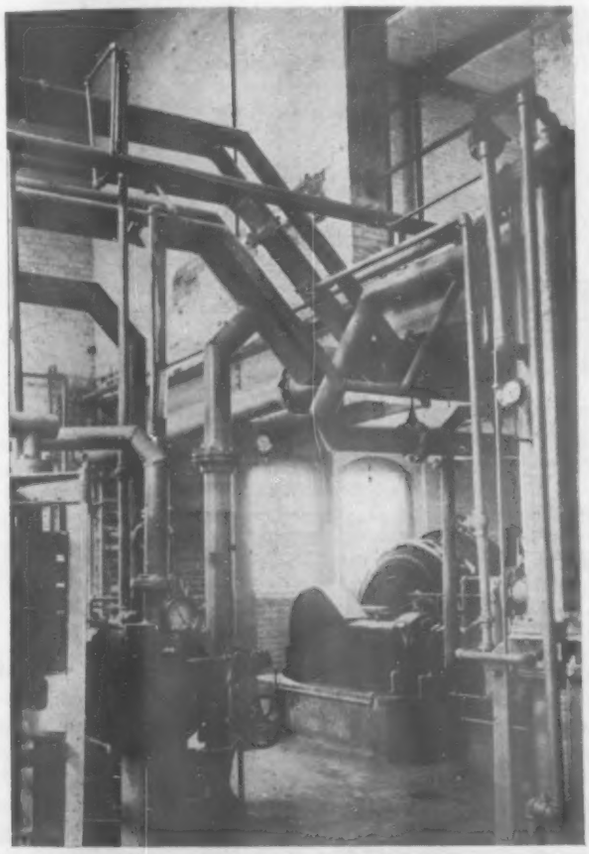


Fig. 7. Complicated Pipe System Made with Welded Joints. Such a Layout Can Profitably Be Developed and Dimensioned on the Drawing Board and Constructed Entirely in the Welding Shop.

More needless expense, both in drawing room and foundry can be saved by oxwelding the outlet gates to the bottom of each hopper. This particular dust collecting system required at least fifty different drawings for these castings, to accommodate the different slopes of the hopper sides. Each drawing required an individual pattern to be made. At least three out of every four of these specials could have been eliminated by merely butt welding the cast iron gate housing to the end of the steel hopper, using bronze welding rod.

Incidental advantages, beyond the cost of drawings, are also worthy of attention. The load supported by these hoppers (a few feet of flue dust) is so moderate that the minimum plate thickness required for rigidity during handling and for corrosion allowances ($\frac{1}{16}$-in.) was selected for the riveted design. However, a saving of all lap joints is effected by welded corner seams; this amounts to 158 lb. on a hopper weighing 880 lb., or approx. 18 per cent of the steel.

Finally, a pronounced operating advantage would accrue. The dust collecting system under discussion was designed to produce a fairly strong draft. Unfortunately, there were so many small holes at the corners of hopper connections, and so many tiny leaks along the single riveted seams, that the operation of the entire plant was seriously hindered for months —in fact, until a great amount of caulking, filling and patching had been done.

We may therefore recount the savings from an oxwelded hopper system as follows:

Saves more than half the draftsman's time on details
Saves 90 per cent the time in the layout shop
Saves three quarters of the pattern expense on gates
Saves 18 per cent of the steel required
Eliminates operating troubles due to draft leakage

Certainly this is an imposing array of economies.

Fig. 8. A Pipe Manifold, Which Would Be Extremely Difficult and Expensive to Construct If Fittings Were Used. Welding Simplifies Such Construction to a Very Great Degree Especially Where Close Clearance Is Necessary.

Pipe Systems

Very large savings in material can be made when pipe systems are designed for oxwelded joints. Incidental savings of large amount can also be made in labor charges, both in the shop and in erection, if proper attention is given the matter when it is on the designer's desk.

Since the standard pipe thread for screwed fittings 3 to 10 inches in diameter is about one-tenth of an inch deep, it follows that the wall thickness of any such pipe, (whether standard weight, extra or double extra strong) could be reduced one-tenth of an inch were the joints to be welded. That extra metal is added to the entire length of the pipe so that a few inches of it at the ends can be cut away again for threads. This one-tenth of an inch amounts to a surprisingly large amount of metal—for instance it weighs a ton for every 300 feet of 6-inch pipe!

This does not mean, of course, that wall thicknesses of pipe can be figured exactly and pipe of this material then purchased. It does mean, however, that in many power installations standard weight pipe (unthreaded for welding) would be as suitable for the purpose intended as extra strong pipe for screwed flanges and fittings. It also means that for long oil and gas transit lines, pipe makers will furnish "line pipe" of considerably thinner wall and longer lengths, unthreaded and beveled for welding, than the corresponding sizes of pipe for screw couplings.

All these make for lower first cost of materials without jeopardizing the utility of the line in the least.

It has been found very desirable, from the standpoint of overall economy, to spend some money on the design and layout of intricate pipe systems for power or pumping plants and industrial works, even in pipe of moderate size. In the past, only enough information would be given on the drawings to indicate the size and weight of the pipe to be used, and its general course from one point to another. The pipe

fitter on the job would make the necessary measurements from point to point, cutting and threading the individual lengths to fit, one after another, very laboriously with bench tools. Even if there were no delays for missing or unordered fittings, this method is very costly in time and labor.

Such layouts as shown in Fig. 7 (and even for simpler ones) can profitably be developed and dimensioned on the drawing board and constructed entirely in the welding shop. The various portions, in convenient lengths for shipping and handling, are then erected one by one from inlet to outlet, in a small fraction of the time previously required. In such construction, flanges are only necessary where pipes must be dismounted frequently, where valves are inserted, or when steel is connected to cast iron, brass or bronze.

Pipe shops doing such work rapidly accumulate the required templates for making conventional angles and outlets in the usual pipe sizes. Likewise many workmen become very handy in making unusual joints by cut-and-fit. Where special angles, as shown in Fig. 8, or intersections off center are

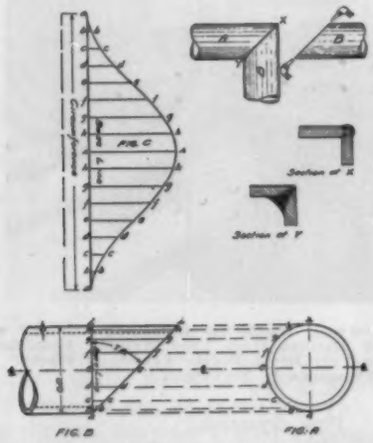


Fig. 9. Sketch Showing Templet Layout for a 90 Degree Turn or Ell, Made from Pipe Mitered for Welding.

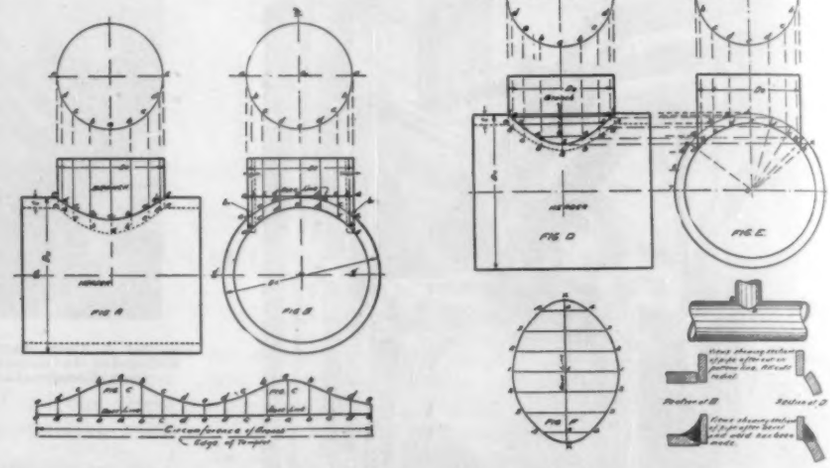


Fig. 10. Templet Layout for a 90-Degree Branch Connection, the Pipe Branch and the Header Being of Unequal Diameters.

desired, especially where close clearance or dimension is encountered, it would ordinarily be cheaper in the long run for the draftsman to work out the intersections by the principles of descriptive geometry, and forward full size developments to the pipe shop for use as templates.

Such a template for a "stove-pipe angle" is indicated in Fig. 9. It will be noted that the working surface is the **outside** of the pipe, the blowpipe makes first a miter cut, and then makes a second cut on each leg at a continually varying angle to the miter plane in order to open up a vee for welding.

Another template for a 90 deg. branch is indicated in Fig. 10. Note that a curve is laid out on the outside of the main pipe in such a manner that when the blowpipe makes a cut normal to the surface at all points, the **bottom** of the cut will just clear the outside of the intersecting pipe.

Obviously, it is important that the method of laying out and position of the blowpipe when cutting should be plainly shown on all such templates.

Experience of many years with thousands of miles of oil transit lines proves that the simple vee, butt joint is amply strong enough to develop the bursting strength of the pipe along a longitudinal element. This fact has been recognized in power piping codes. Fig. 11 shows the design of joints contained in the Code for the Welding of Steam Piping, State of Michigan.

Many methods of attaching flanges to welded pipe have been proposed; several satisfactory designs are shown in Fig. 12. If it is necessary to have a very smooth, unwarped plane surface of the flange, the long skirt design with a butt weld will be satisfactory. The Grinnell Company standard Van Stone flange connection is shown in Fig. 13.

Methods of welding nozzles and openings into pressure vessels are shown in Fig. 14, taken from the American Society of Mechanical Engineers' Unfired Pressure Vessel Code.

PRESSURE VESSELS

A great mass of very valuable information can be drawn from the Bureau of Standard's tests on the proper design of pressure vessels. It would take us too far afield to analyze these results. They are quite accessible, having been printed in Bulletin No. 5 of the American Welding Society, and well warrant the close attention of all engineers interested in welded design.

Suffice it to say that a vessel having a bursting strength to the ultimate strength of the original steel sheet can be made with double vee longitudinal butt joint, heads dished outward and connected with the shell with single vee circumferential seams.

In general, the following principles should control the design of all oxwelded joints:

(a) Arrange so the flame can penetrate and melt the metal to the very bottom of the joint without excessive overheating. (This is the reason for double vee welds on thicker plates and also the reason why lap joints are generally unsatisfactory.)

(b) Avoid welds between metals of widely different cross section. (This is the reason why the heads of pressure vessels are reduced in thickness at the girth seam. This is also another reason for not welding lap seams.)

(c) Avoid placing a weld where compound stresses must be carried. Bending, especially if when combined with possible impact, is to be avoided. Avoid especially places where a slight movement will induce much splitting or prying action.

(d) In the layout, avoid intersections of welds meeting as a cross. (It s especially difficult to avoid overheating where four seams join.)

As to allowable strengths:

Ample experience is now available to show that a competent, tested workman, welding under adequate supervision and with good materials and equipment, will be able to produce weld metal consistently which has the following tensile strength:

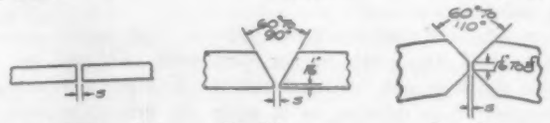
Welding Rod Used	Ultimate Tensile Strength of Oxwelded Metal
Plain Low Carbon Steel	43,000 lb. per sq. inch
Nickel Steel	48,000 lb. per sq. inch
High Test	50,000 lb. per sq. inch

(Shearing Strengths, based on the surface developing maximum shear, can be safely figured at 80 per cent of the above figures.)

Since butt welds are normally reinforced at least 20 per cent, and since double vee welds are inherently of higher quality than single vee welds, conservative figures for the strength of reinforced welds in boiler plates, based on the thickness of the plate rather than the actual thickness of the weld, are as follows:

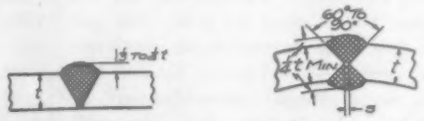
ULTIMATE TENSILE STRENGTH

Welding Rod Used	Single Vee Oxweld	Double Vee Oxweld
Plain Low Carbon Steel	45,000 lb.	52,000 lb.
Nickel Steel	50,000 lb.	58,000 lb.
High Test	52,000 lb.	60,000 lb.



For Pipe 7/32 in. thick or less. *For Pipe over 7/32 in. thick.* *For Plate ½ to ¾ in. thick.*

Design and Assembly of Joint
S is the space after tacking and should be about 1/16 in.

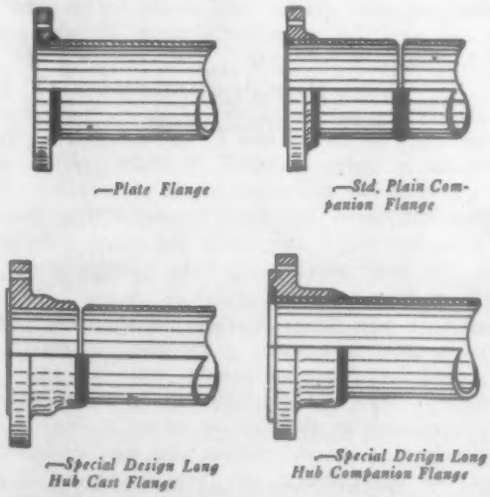


Reinforcement on Single Vee Weld. *For Plate ½ to ¾ in. thick.*

Design of Butt Welds.
Code for the Welding of Steam Piping, State of Michigan.

Fig. 11. Recommended Designs of Joints for Welded Steam Piping.

The above figures are based on a very large number of tests, published and about to be published taken from the work of over a hundred welders of ordinary ability working in various shops throughout the country. It is therefore believed that they may be duplicated with ease at any time and placed where it is desired to do so.



—Plate Flange *—Std. Plain Companion Flange*

—Special Design Long Hub Cast Flange *—Special Design Long Hub Companion Flange*

Fig. 12. Many Methods Have Been Suggested for Attaching Flanges to Pipe. Some of These Are Shown in This Illustration.

There are those, of course, who would exclude welded joints from all important construction. Such people disregard our accumulated experience with chain and chain cable. For centuries chains have been used wherever the utmost of strength, toughness and reliability is required. Results have been so uniformly satisfactory that today the heaviest loads are hoisted, and the biggest ships ride safely at anchor, with chain cable; each link having a weld!

One is tempted to rest the argument with that simple statement, were it not necessary to harmonize it with the fact that welds made in a blacksmith's forge are quite variable in quality. The latest edition of Johnson's "Materials of Construction," the standard college text on strength of materials, contains the following on page 607:

"On account of the difficulties encountered in welding, the strength of forge-welded joints in wrought iron is likely to vary from 30 to 100 per cent of the strength of the parts joined. With the most careful hand welding Kirkaldy reports the average efficiency of joints in round tie rods 1½ to 3⅛ in. in diameter as 60 per cent."

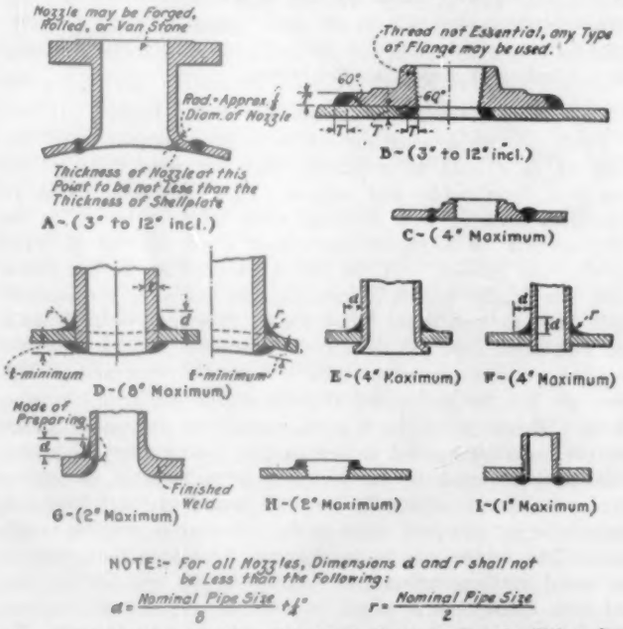
Such low strengths are undoubtedly due not to an inherent impossibility of getting a sound weld in wrought iron, but to the fact that each smith is a law unto himself; his work is seldom or never tested in a scientific manner; and his tools

Method of Attaching Flange, Grinnell Company Standard

Fig. 13. Sketch Showing a Method for Attaching a Van Stone Flange.

and skill may be entirely inadequate for the work.

Contrast this with the methods in use at the Boston Navy Yard, where chain cables for our warships are made. The material is Grade A, double refined wrought iron, purchased under the most rigid specifications; the joints or "scarfs" are prepared systematically in special machinery; the heating is done in well designed furnaces; welding is done under power hammers of proper size and equipped with carefully designed mandrels or dies; double links are removed at random from each chain to test the strength of that chain and to verify



NOTE:- *For all Nozzles, Dimensions d and r shall not be Less than the Following:*

$$d = \frac{\text{Nominal Pipe Size}}{8} + \frac{1}{4}" \qquad r = \frac{\text{Nominal Pipe Size}}{2}$$

Fig. 14. Methods of Welding Nozzles in Pressure Vessels, Taken from the American Society of Mechanical Engineers, Unfired Pressure Vessel Code.

the workmen's proficiency; and the finished chain is annealed at 950 deg. C. (pyrometer control.) Finally each chain is given a proof test so severe that it actually stretches about 5 feet in a hundred and each weld is then given the most rigid inspection.

In other words, chain cable is made under true procedure control; under adequate and close *design* of every step. And what is the result? Mr. C. G. Lutts reported to the American Society for Testing Materials in 1920 that during the preceding four years, 4196 stud chains ranging from 2¼ to 3¼ in. in size and each containing about 100 welds had been made. Just two links failed to pass the proof load! As before noted, each one of these chains had at least one doublet tested to destruction, and the grand average for four years showed that chain cable made under procedure control developed 112 per cent of the strength required by the U. S. Navy!

The conclusion is obvious. "Hit-or-miss" welding is worth 60 per cent, maybe. "Procedure Control" welding will pass

(Continued on page 50)

Effect of Surface on Steel Electrodes

The Effect of Surface Materials Seems to Be Fully as Great as the Effect of Chemical Analysis, Especially in Electric Welding

By J. B. Green, M. E.*

MUCH attention has been quite properly paid to the chemical analysis of welding rods but every welder knows that a rod may be of so called perfect analysis for a particular job and still will not work satisfactorily. This is due to the fact that analysis is only one out of a great many factors involved with welding rod quality and no one of these factors of itself controls. A few people here and there seem to have had some hazy ideas that the surface materials exerted at least some influence but apparently no definite attempt had been made to investigate the matter with any degree of completeness when our Research Department undertook it several years ago. The results of this work seem to clear up much welding phenomona which has in the past been mysterious at least to most men engaged in practicing the art of welding. Surface materials play a part in both gas and electric welding but their significance in connection with metallic arc welding is the greatest. While the subject matter of this article is divided into that which pertains especially to gas and especially to electric welding, still, to avoid repetition, there is necessarily much in each part which also applies to the other.

Surface Materials on Gas Filler Rods

There are three materials which might appear on the surface of filler rods as ordinarily made by wire mills. These are lime, iron oxide, and copper. Lime and iron oxide are lubricants used in wire drawing when what is known as the "dry process" is employed and copper when the rod is drawn by the "wet process." If the rod is annealed as the last operation, this usually results in covering the rod with a reasonably thick layer of iron oxide called scale. This scale is black while the iron oxide used for lubricating is reddish in color. A mixture of tin and copper is quite common in wire mills. This gives the rod the appearance of brass plating and it is known as "Liquor Bright Finish." A great many tests covering all these surface materials applied to low carbon, high carbon, and alloy rods have been made by our Research Department in the laboratory and extensive observations over a period of years have also been made in numerous shops under commercial welding conditions. The results can be summarized by saying that none of the metal surfaces affect gas welding in any way, while lime and iron oxide, which might be classed as non-metal surface materials, interfere in proportion to the quantity present. No differences can be noted as between filler rods coated with copper, tin, cobalt, nickel or mixtures of these either so far as flowing qualities under the torch or quality of the weld deposit is concerned. They are all equally good. In the case of lime and iron oxide, quite the reverse appears to be true. If there is an appreciable quantity present, it interferes with smooth flow. These materials do not alloy with the steel of the filler rod but float around as bright specks on the liquid weld puddle. A certain percentage of these specks usually seem to get entangled with the weld metal just as it solidifies and become slag inclusions. These, of course, weaken the weld.

So far, no wire mill has succeeded in drawing low carbon rods by the dry process without leaving some lime or iron oxide or both on the surface. To entirely remove these materials, the rod must be pickled and wet drawn. So long as all the metals which might be applied in conjunction with the wet drawing process work the same for welding, it is logical to prefer copper. It is the cheapest and its color tells anyone at a glance whether or not the filler rod has been made by the wet process, and therefore, whether it is entirely free from lime and iron oxide.

Somewhat different conditions apply to high carbon and alloy rods. These are much harder than mild steel and by using care in the wire mill, so nearly all the lime and iron oxide can be scraped off in drawing as to make dry drawn, or bare rods, suitable for gas welding. While wire mills which have not made a careful study of the effect of surface materials on filler rods may draw high carbon and alloy rods just the same for both gas and electric welding, they are not serving the welder with the best rod if they do this. The gas welder should insist on the brightest, cleanest finish obtainable while the metallic arc welder wants all the lime on his rod he can get.

The gas welder should never use any filler rod which has been black annealed as the last wire mill operation. Only under very unusual conditions, is it necessary for the gas welder to use a rod which has even been annealed in process. Very occasionally it is necessary to weld in a place so small a man can barely get in and then the welder must have a rod which he can wind up much like string solder. Under such conditions, a Bright Annealed Coppered Rod is really the only one to use, and then the extra cost of such a rod is justified.

The conclusion to be drawn from these investigations is that the popular coppered finish for gas welding rod probably can not be improved upon in the low carbon grades while, in the high carbon and alloy grades, care should be exercised to see that the rod used has a perfectly clean surface so far as lime and iron oxide is concerned.

Surface Materials on Electrodes

Unfortunately the subject of the effect on welding of non-metallic materials on the surface of or otherwise incorporated with electrodes is highly scientific. It really involves most of the laws governing the mechanism of the metallic arc. On this account, only the more important phases will be covered in detail in a popular way in this article and some of the scientific foundation, for those who care to make a deeper study of the matter, will be given in a later article.

Experiment with Three Surfaces on One Electrode

The starting point in a study of the effect of surface materials is to first find out what happens when they are entirely absent. An interesting demonstration can be made in this connection by preparing an electrode as shown in Fig. 1. Select what is considered a smooth running mild steel electrode. The analysis of this is, of course, the same throughout its length. The surface materials only are varied as indicated in the figure. The flux coating may be omitted, leaving only the natural bare finish and the polished surface for the experiment. If the flux coating is included the top third of the electrode may be dipped in silicate of soda or in acetylene generator sludge and dried for this purpose.

Unless the electric welding generator has unusually large ballast resistance or steadying inductance and windings, it is very easy in running this experimental electrode to tell, as the rod melts, when the change comes from one surface to another. If a bead is laid down on a plate, the surface of this bead also changes with each change of electrode surface.

When the polished surface is running, the arc is almost impossible to hold. The operation smooths out when the natural bare surface is reached and the arc becomes very steady while the flux-coated portion is running. Few welders, until they have tried this experiment, realize that what they have always called "Bare

*Research Department, Chicago Steel & Wire Company.

Electrodes" are not really bare but have something on the surface which, when removed, makes an otherwise good electrode almost unmanageable.

Surface Materials on Bare Electrodes

What is really on the surface of these bare electrodes is mostly lime, often also containing rust and also a little soap or grease. These are the common wire mill lubricants. Electrodes are drawn down to size in the wire mill by passing the wire cold time after time through drawing dies, each a little smaller than the preceding, until the finished size is reached. During this process the wire is in large coils, not being straightened and cut for electrodes until later. If the wire were not properly lubricated during drawing, it would break up into small pieces and the drawing become impossible. The more times the wire is drawn through the dies, the less lime, etc., is left on it. Slight changes in the steel, too slight to be otherwise detected, give trouble in the drawing and require changes in the dies. Every little change causes a variation in the quantity of residual lime left on the wire when it has reached finished size. Inasmuch as the working qualities of electrodes depend to such a great extent on the

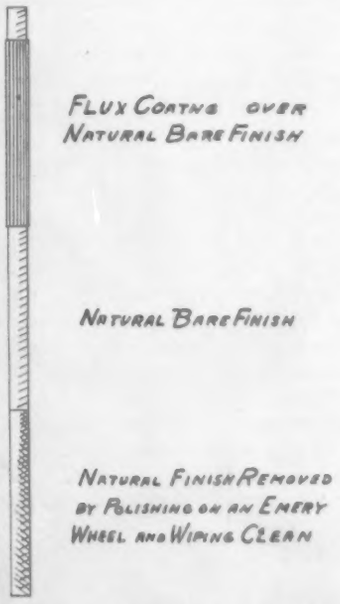


Fig. 1. Diagram of a Test Filler Rod for Demonstrating Effect of surface materials.

quantity of residual lime on their surfaces, it is easy to understand why there can be a wide variation in these working qualities. Few electrode manufacturers have in the past appreciated the importance to the welder of this residual lime and it is a wonder bare electrodes have had much of any uniformity. The extremely skillful welder is able to compensate for much of this lack of uniformity and modern welding generators have been ingeniously designed to take care automatically of some variation in electrode properties. It seems illogical, however, to ask the welder and generator manufacturer to use their efforts to compensate for the shortcomings of the electrode producer. An attempt has been made in the right direction by offering the welding industry flux coated electrodes. The main function of these is to stabilize the arc and the benefits from increased arc stability are far greater than merely making the work easier for the welder, as will be explained later. One general objection to flux coated electrodes is their cost. Rather than obtain the desired arc stability at an increased electrode cost through flux coating, it would seem more logical to accomplish it by improving and standardizing the surface finish of what have been called bare electrodes. Such improvement should give a uniformly stable arc permitting the highest quality work with both direct and alternating current. Flux coating would still have its field of usefulness, a field which has been hardly touched as yet. This is the field of special work and here an increased electrode cost is fully justified.

Standardized Surface

What is meant by a standardized surface can probably be explained in the fewest words by telling the story of the development of *Weldite* Green Surface Electrodes. When the Research Department discovered the true significance of surface materials on electrodes, the first attempt to apply the knowledge consisted in controlling the quantity of residual lime left on the wire. It was found that much could be accomplished this way. It put an extra burden on the wire drawer, however. He has his hands full when he succeeds in drawing wire economically and accurately down to size. If in addition he has to finish all sizes with a definite coating of lime remaining, it is asking too much. This is especially true because it is impossible to tell just how much lime is left by looking at the wire. The greases and soaps mixed with the lime in drawing seem to make the lime sort of transparent on the surface. For instance, an electrode may not seem to have much lime on it. By dipping in water the soapy grease seems to be dissolved out and the electrode then looks as if it had a great deal of lime, although, of course, none has been added. This means that the quantity of soap and grease which happens to get mixed with the lime in drawing varies, which in turn may result in a thin lime coating appearng like a thick one and vice versa. The true quantity of lime not the apparent quantity is what counts in welding. Another difficulty was encountered in trying to apply the proper surface during wire drawing. No materials could be used that were not the best wire mill lubricants and this did not mean they would also be the best surfacing materials for welding. Still another difficulty lies in the fact that maximum arc stability seems to require just a slightly greater quantity of surface material than the maximum that can be applied during drawing. When all these points had been developed, it became evident that the thing to do was to apply the surface as a separate operation and of so distinctive appearance that the electrodes could not in any way become confused with what have been called bare electrodes.

A method was developed whereby the electrodes can be uniformly treated in mass at a low cost and enough saved by relieving the wire drawing operation of the necessity of leaving a lime coating to offset this. It should be noted that the sort of surface being discussed is not a flux coating. It is simply the bare finish to which everyone is accustomed improved, standardized and made readily recognizable.

Benefits of Standardized Surface

Such a surface on electrodes is a very great benefit to the welder. On high carbon and alloy rods it has never been possible to leave much residual lime because the hardness of these electrodes causes practically if not quite all the lime to be scraped off each time the wire goes through the die. This new surface makes these high carbon and alloy electrodes manageable without the necessity for flux coating. On the low carbon electrodes, the standardized surface gives a high degree of uniformity of working. The electrodes work with entire satisfaction on alternating current as well as direct.

Significance of Arc Stability

This phase of the effect of surface leads to a discussion of the general significance of arc stability from the standpoint of welding. It is self-evident that the more stable the arc, the easier the welder's work. A stable arc means much more than this, however. If the arc is stable the metal must pass across in a regular stream of small particles. The result is bound to be a sounder weld with the chances that occluded slag and blowholes will not be present. It is not always possible to guess at what is below the surface of a weld from its surface appearance, so anything that makes weld metal more dependably uniform is highly desirable and a uniformly stable arc contributes a large measure toward this end. Loss of metal from sputtering is reduced with increased arc stability. A shorter arc can be maintained when the electrode flows smoothly. The short arc reduces the time that the metal is in contact with the air while passing across from the electrode and thus seems to reduce the quantity of iron nitride and oxide in the deposit. Both of these compounds

tend to make hard welds. The short arc is also a great help in overhead and vertical position welding.

Significance of Various Surfaces

The effects of arc stability are far reaching and the reason that the proper surface materials increase arc stability seems to rest largely on the fact that they must reduce the arc vapor resistance. This at least appears more logical than the assumption that surface materials refine the electrode metal. If this were the case, they would have no effect on pure iron which is already refined but they stabilize the arc here as much as on electrodes from impure iron. When these surface materials are present in quantity as in flux coatings, the slag from such coatings which passes across and floats on top of the weld might refine the metal after it is deposited. This is unlikely, because the deposit cools almost instantly to the point where the slag and metal are no longer liquid and refining by slag contact can only take place while both slag and metal are liquid. This is the process of refining carried on in the Open Hearth Furnace and it takes many hours to accomplish it. Flux Coatings therefore seem unnecessary when their only function is to stabilize the arc. A surface can be made to do this and give all the secondary benefits that go with arc stability. When something in addition to arc stability is required, special flux coatings appear to be the only answer. For instance, it may be necessary to weld at the bottom of a deep, narrow groove. The arc would jump from the side of the electrode if it were not protected by an insulating coating. Again it may be necessary to carry across some of the ingredients of the electrode which ordinarily would be burned out, in order to give the weld metal the desired physical properties. A special flux coating is about the only way to accomplish this. Extreme penetration is essential at times and again practically no penetration at all is desired. A slow flowing rod may be the best for certain work and an extremely fast flowing one must be used for other work. All of these extreme or special cases represent problems to be solved by flux coating.

While flux coating is really included in the subject of this article and its general significance is indicated in the discussion of the effect of surface, still to go into the matter thoroughly would probably require an article as lengthy as this one for each special coating, so the reader should not get the impression that flux coatings are unimportant merely because this particular article does not discuss them in detail. Much the same remarks could apply to the oxide surface of what has been known in the industry as "Black Soft Electrodes." The working qualities of this type of electrode depend not on its softness as is generally supposed, but on the presence of surface scale. Such scale is incidental to the annealing operation carried on in the wire mill and its thickness is subject to variation for much the same reasons as the residual lime is on "Bare Electrodes." Wire mill annealing equipment is designed to uniformly soften the wire, not uniformly scale it for welding.

Conclusions

The effect of surface materials on both gas and electric filler rod seems to have a great deal of significance so far as metallic arc electrodes are concerned, this significance appears fully as great as that of chemical analysis. Indications are that filler rod specifications which do not specifically mention surface materials are lacking in completeness and will not protect the user against inferior rods. It is hoped that the subject matter of this article will not only help the welder to better judge the filler rod he is using, but also point the way for those concerned with writing specifications to improve the existing ones.

(NOTE—This is one of a series of articles by Mr. Green in which the welding qualities of electric and gas welding rods will be discussed. The observations made and conclusions drawn are the result of a long series of experiments but it is recognized that other investigators may have formed different conclusions as a result of experiments made in other ways. Correspondence is therefore invited on the subjects covered, in order that any errors made in conclusions may be corrected and any data which serves to confirm the conclusions given will also be welcomed. It is felt that much good will result from a thorough discussion of the different characteristics of welding rods and wire.—Editor.)

WELDED TRUSSES UNDER TEST

A series of four roof trusses was tested to destruction at the Engineering Laboratory of The Linde Air Products Company, Buffalo, New York, during the week of May 10; the culmination of a year's intensive study of the proper application of oxy-acetylene welding to the fabrication of steel structures.

As a first step, studies were made of various types of joints in various kinds of steel shapes. A few of the most promising schemes were then built into typical truss intersections, and proper jigs built to load these joints to destruction. Unit stresses for weld metal in tension, compression and shear were determined by this means. The variety of joint known as the "plate insert joint" was shown to have marked advantages.

Next a 40-foot roof truss was designed and built of conventional angle-iron sections, using the information gained by this preliminary work. In testing, very elaborate framework was necessary to give the upper chord of the truss the lateral support it would receive when placed in a building. Platforms were hung from each panel point and loaded with pig iron.

At definite increments of load the stresses in each member were measured by an extensometer. At double the design load, each welded joint was vigorously pounded with a heavy hammer. At 3½ times the design load, the truss failed by buckling in the upper chord—no distress at any welded joint was in evidence. At the time of failure the truss designed for 21,000 pounds load, was carrying 75,000 pounds of pig iron.

Having thus demonstrated the soundness of the underlying methods, four trusses were prepared for comparative test. One was designed and built by a leading structural shop; another was welded by the Linde Company, using members of the same size from the same mill rolling; the third was designed to have the same strength as the riveted truss, but since the oxy-acetylene welded joint allows a better placement of the metal, it was materially lighter in weight. A fourth truss was welded of tubular sections.

A summary of the final result follows:

Style	Weight	Total Load at Failure
Riveter Truss	1161 lb.	62,000 lb.
Welded Truss of equal weight	1150 lb.	72,000 lb.
Welded Truss of lighter weight	1079 lb.	70,000 lb.
Welded Truss of tubular sections	916 lb.	63,000 lb.

All trusses failed by buckling of the top chord, a compression member. In no instance were there any signs of distress at a joint.

These tests were made under observation of engineers from the Pittsburgh Testing Laboratory, and in the presence of several independent observers and representatives of Governmental departments. More detailed results will be available as soon as the formal report is made by the Pittsburgh Testing Laboratory.

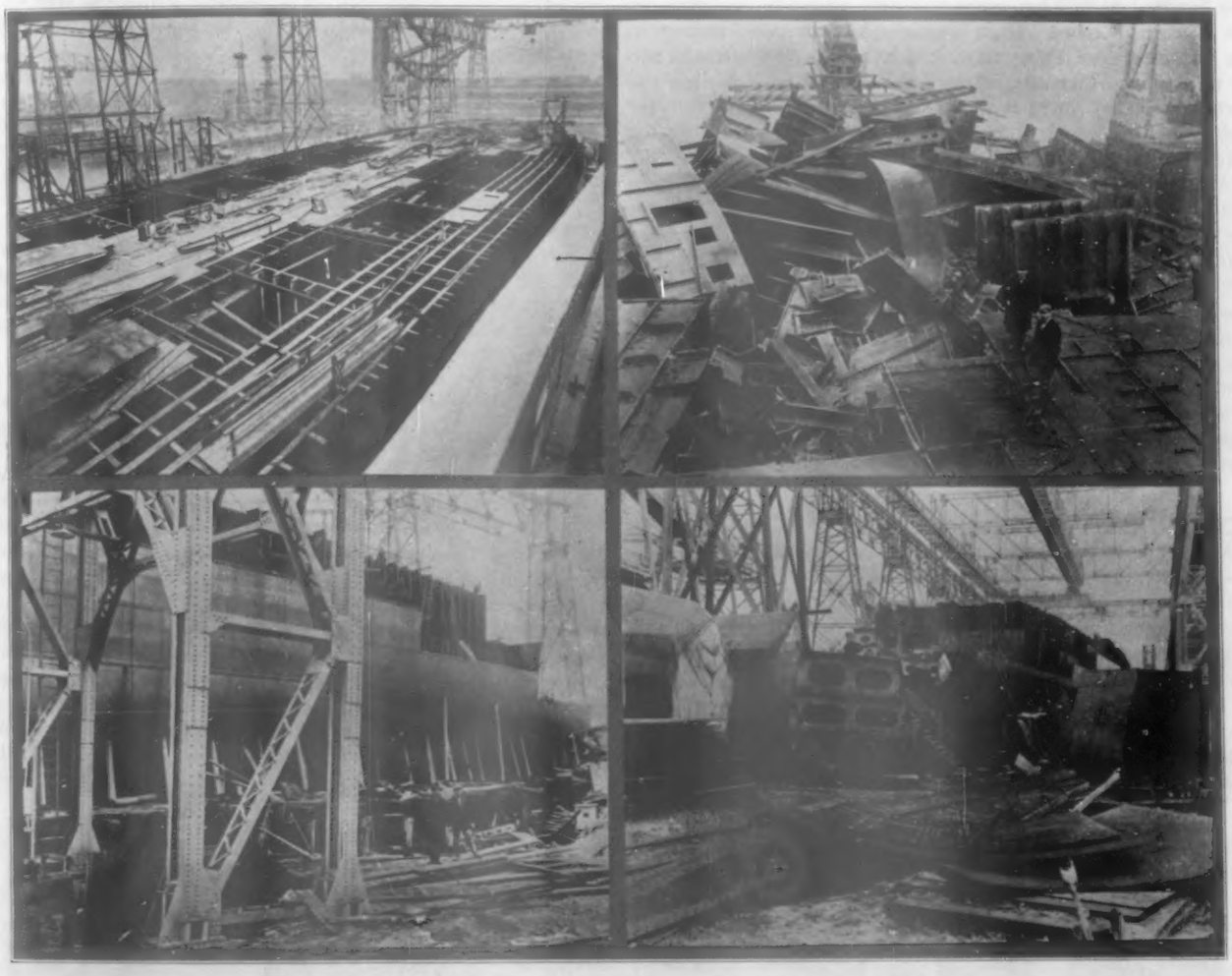
LOS ANGELES SECTION HAS JOINT MEETING WITH AMERICAN SOCIETY FOR STEEL TREATING

At the May meeting of the American Welding Society, which was held on May 20th, the Los Angeles chapter of the American Society for Steel Treating was invited to participate. The speaker of the evening was Mr. W. F. Stoody, whose paper was on the subject of the welding of heat-treated parts and the heat-treating of welded parts. The discussion of this paper was followed by the presentation of a short sketch to illustrate some of the characteristics of salesmen who are selling to the local welding trade.

The Ship Scrapping Industry

Contractors Find Various Ways to Reduce Costs of Cutting up Steel Ships and Similar Structures With the Oxy-Acetylene Cutting Torch

THE disarmament conference in Washington of the powers of the world decreeing the destruction of a vast amount of naval tonnage and adverse world trade conditions, causing a surplus merchant marine tonnage, have resulted in the expansion of the ship scrapping industry in the United States. The increase in ship building during the war gave the United States a merchant marine of large proportions, but with the end of hostilities, and the resultant relapse in world trade, the United States Shipping Board was forced to place approximately 1,000 of its vessels on its idle list. Many of these vessels will never be of any commercial value, and the board, by selling the ships for scrap, has supplied the means for the promotion of the new industry of ship breaking.



Various Views Showing the Use of the Oxy-Acetylene Torch in Ship Scrapping.

The heavily armored warships provide difficult and hazardous hardships to overcome in the dismantling process. In ship breaking the generally accepted method of cutting the metal plates is by means of the oxy-acetylene torch, and with the cost of oxygen and acetylene taken into consideration, one of the most important problems confronting the ship breaker is the economical use of the welding and cutting apparatus. When scrapping is performed on an extensive scale, it has been found advisable and advantageous to install an acetylene generating plant rather than to use the gases from tanks.

In cutting up tanks care should be taken to insure that all pipe lines leading to the tanks are broken and blanked off just above the tanks, and that the pipes are drained of oil and blown out with air. Besides this, it is important that all sea valves should be securely closed and locked, and care must always be exercised that the operator does not cut into sea chests or sea valves. Negligence in this instance would probably result in the sinking of the vessel.

Taking into consideration the prices recently paid for vessels to be scrapped, it is interesting to note the following computation of costs of labor and material for cutting to shipping sizes and loading on cars about 6,000 tons of unpainted structural material erected on the building ways, and about 10,000 tons of armor, 13,000 tons of structural material and 350 tons of nonferrous metals from ships afloat.

Ships on Ways (Unpainted).

	Cost Per Ton
Cost of oxygen and acetylene	$ 1.00
Loading and switching charges, handling gas tanks, crane operators, power	.40
Labor for cutting and laying out cuts	1.00
Total labor and material per ton shipped	$ 2.40

Ships Afloat (Painted).

Oxygen and acetylene	$ 2.30
Transportation, crane operators, light steam, air, power moving vessel, truck service, tug hire	.55

Cutting, removal, loading of ferrous metals, removal of interferences such as wood, cellulose, decking, etc.	3.95
Total labor and material per ton of ferrous shipped	$ 6.80
Removal, segregation and loading of non-ferrous metals	20.00

The Alexander Milburn Company has played a prominent part in the ship scrapping industry throughout the country through the furnishing of welding and cutting torches and other acetylene apparatus, and officials of that company have pointed out that from the above figures it can very readily be seen that in order to obtain a maximum profit from dismantling operations it is necessary to use apparatus which will operate with greatest efficiency and economy.

The illustrations depict operations in scrapping the U. S. S. North Carolina by N. Block & Company at the Norfolk Navy Yard with 17 Milburn Cutting Torches. 10,000 tons of material was involved in this job, more than 90% of which was done by the Milburn Torches. These photographs were prize winners in the Oxy-Acetylene Photo Contest, conducted several months ago by the Milburn Company. They indicate the size of the job undertaken. The contractor who did the work reports that the operation was completed well within the time set for it by the Navy.

Another interesting ship scrapping operation in which Milburn welding and cutting equipment was utilized, was in the cutting of the warships of the German fleet which were sunk in Scapa Flow after the armistice.

Cost records on cutting operations of this magnitude will differ considerably. Contractors and supervisors find various ways to reduce costs or increase them, according to their familiarity with the work. To look at a cutting job of this size is enough to make one realize that there is always a chance to devise additional economies in cutting operations, even though it is generally accepted as the cheapest method of demolition on ferrous structures.

COMPLETE PORTABLE WELDING PLANT

A new portable Fordson-Westinghouse electric welding plant has just been built by the Barton Brown Engineering Corporation, 1109 Santa Fe Avenue, Los Angeles, which, under trial, meets every condition which can be exacted from such an outfit.

The motive power and the power plant for operating the dynamo is a Fordson tractor. Practically the only changes made in the standard construction of the Fordson is an elongation of the wheel base to 117 inches, the substitution of rubber tired wheels, both front and rear, for the standard steel wheels, a Smith unit clutch and a twelve-inch pulley for the power take off and the addition of a Pharo oil turbine type governor. The cost of the tractor, less the steel wheels, is $555.

The welding plant is carried on a six-inch channel steel frame which surrounds the tractor proper. This frame is electric welded and is very strong. It is supported at the front end on a spring with a bearing in the center, giving a three-point suspension so it cannot be cramped or twisted when running over unevenness of the road. At the rear, the frame rests on the rear axle housing of the tractor and has two cross members in front, one running under the crank case of the tractor and the other supporting the front of the tractor where normally the front axle is located.

The dynamo is the new type Westinghouse, of 200-300 amperes capacity, with electric exciter, and is belt-driven by a double ply, six-inch leather waterproof belt from the power take off on the tractor. The twelve-inch pulley is wooden faced and the dynamo has a large steel fly wheel to give it constant speed when the load fluctuates due to welding. The pulley on the power take off of the tractor can be disconnected when not in use by means of a standard Smith unit clutch. The speed of the power take off is kept constant for welding by means of a Pharo oil turbine governor.

Standard Ford head and tail lights for night running are operated from a thirteen-plate storage battery which is kept charged from the welding dynamo through a relay and resistance units. The storage battery also is used for ignition, making the outfit easy to start in cold weather. The control rheostat, ammeter, voltmeter and so forth, are in a steel box in front of the dynamo and the storage battery sits directly under this.

The rear seat is a special cushioned affair with an upholstered back and rests upon a spring. The exhaust gases are carried straight up through the muffler, keeping poisonous gases away from the operator. Tool box and rack for oxygen and acetylene bottles are back of the driver's seat.

The increase of the wheel base to 117 inches and the use of rubber tired front and rear wheels makes it possible to transport the plant over boulevarded roads anywhere. It steers very easily and is easy riding.

The price of this unit as described totals $2700. Of this, the tractor, less the steel wheels, contributes $555; the generator, $847. The Barton Brown Engineering Corporation contributes $1298 to this total, which covers the cost of producing the framework, the cost of mounting, engineering, wiring, clutch, pulley, governor, 40x4-inch rubber tired wheels in rear and 24x3½-inch rubbed tired wheels in front, extra Fordson axle and the other small appurtenances which enter into its construction. Under test, it has proven to be remarkably efficient and commends itself both for that and for its extreme mobility. As described, the outfit has a road speed of sixteen m.p.h., but by expending an additional $75 for a high speed worm, this speed can be considerably exceeded. In other words, under its own power this outfit can always go to the job.

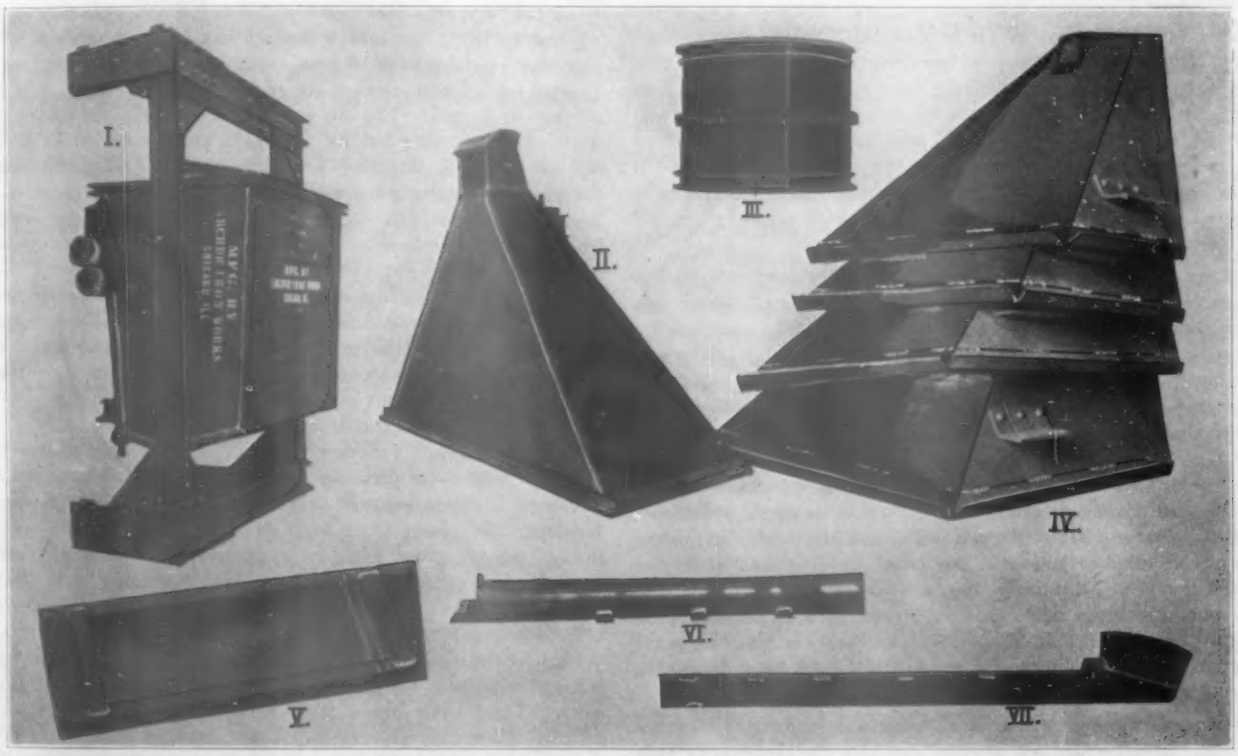
Complete Portable Welding Plant.

Welding in the Conveyor Industry

Bolting and Riveting is Giving Way to Electric Arc Welding in the Construction of Concrete Mixing and Conveying Equipment

UNTIL a year or two ago, rivets and bolts were used exclusively in constructing the machinery and equipment used for mixing and handling concrete. The manufactures of this equipment thought that was the only process that could be used. They believed that rivets were the only practical means of construction. Lately, however, they have changed their point of view and turned to electric arc welding for the fabrication of this equipment.

The adoption of electric arc welding has not only made a superior product possible but it has also considerably cut down the cost of manufacturing. For instance where three men could formerly rivet four long concrete chutes a day, now one man can turn out ten of them in the same length of time.



Welded Concrete Construction Machinery.
I. Concrete Conveyor Bucket. II. Concrete Hopper. III. Mixer Drum. IV. Pile of Welded Hoppers. V. Coal and Concrete Chute. VI. Lower Connection Concrete Chute. VII. Upper Connection of Concrete Chute.

This important saving in time and labor is very great, but not as vital, however, as the fact that the job is made much more rigid, much lighter and much more durable. Where the rivets and bolt-heads used to cause friction and stop the flow of concrete, welding allows the material to roll down the chutes without any impediment. The welds cannot shear off as the bolt and rivet-heads used to do and needless to say, when an article is properly welded it is leak proof.

The most important feature of advantage in the welded construction over the riveted construction is that the chutes are absolutely rigid. There is no sway where the sections are joined together, fewer cross pieces are needed and the work on the whole is very much simpler. Heretofore when rivets or bolts were used there was always a lot of play and sway in the joints and the material used also had to be a great deal heavier. Now, with welding, the metal used is lighter, the joints are absolutely rigid and there is no sway and consequently no wearing, shearing, or leakage at the joints. Hole alignment is also eliminated.

The very interesting equipment illustrated in this article was fabricated at the Archer Iron Works, 34th Place and Western Avenue, Chicago. The welding is done under the complete supervision of Mr. Kush who is the plant superintendent in charge of this work.

Mr. Kush at first looked upon welding in a very skeptical manner. He thought welding was merely a fair process to be used for patching up broken parts of machinery where there was no strain. He did not think it was a method which could be used in the fabrication and construction of machinery such as concrete mixing and conveying equipment. This equipment he thought received too hard treatment, and if welded would give a lot of trouble.

One day, however, a welding wire salesman visited his plant and pointed out to him how far superior the welding process was the old-fashioned riveting process. Mr. Kush continued to be skeptical but before the salesman had left he agreed to give it a trial. From then on the salesman kept in touch with the Archer Iron Works and suggested various methods of construction, and when called upon, was even instrumental in securing competent welders for the work.

The first few men who worked on this job did not prove very satisfactory. They had been working on other kinds of metal and other types of work. Although they were good welders, still several failures resulted. Mr. Kush lost his faith in welding again and had to be entirely resold by the

same welding wire man. This time he suggested that his first plan be adopted, which was to secure a good competent man within the organization and train him to be a welder. Mr. Kush decided to try this plan and took a lot of time to decide who would be best fitted for the task of welding supervisor and trainer of welders.

The man Mr. Kush selected to break in as a welder happened to be the best riveter, who was the most valuable man he had in the organization. It was only a short time before this man was also entirely sold on the welding process. He found it far superior to the riveting process for he could see that he was turning out a great deal more work than he had been able to do under the old method and that the work was of a much higher standard. At first while the program of training was going on the plant was only operating at about 20 per cent efficiency. But now after systematically going after the problem Mr. Kush reports he is operating on about a 95 per cent efficient basis in his welding department.

Aside from the welding as applied to this particular type of machinery the entire attitude of the plant has been changed. Now, when any piece of machinery is broken Mr. Kush immediately thinks of his arc welder and decides that it should be repaired or rebuilt with arc welding. In this way alone he has saved the cost of his original installation many times over. By being able to quickly repair costly machinery at a very low figure he has saved the time which would have been lost if it had been necessary to take down the machinery and wait for new parts to be shipped and installed, and in addition the price of the new parts. In other words, he has had an unbroken chain of operation which has been entirely unaffected by breakdowns or accidents to the machinery around his plant.

In the illustrations, No. 1 shows a concrete conveyor bucket which is all welded except the supporting frame. There has been some thought of welding the frame but owing to the shipping of the conveyors to various parts of the country it has been found advisable to use bolted construction so that the frame can be knocked-down and shipped in a smaller crate, rather than ship the conveyor all in one large awkward piece. For city shipment, however, Mr. Kush plans to use welded construction for the frame. Before welding was adopted this bucket was a very ungainly affair with large angle reinforcements bent around each corner and riveted through with many rivets. Now there is just a lap seam weld around each end of the bucket. Naturally the job is much smoother and very much stronger and more rigid than before. Another important feature of this bucket is that there is absolutely no concrete leakage. The metal welded is 14 gauge and on this type of work they use a 1/8 inch to 5/32 inch coated rod.

A concrete hopper which is all welded is shown in illustration No. 2. The flanges around the top are riveted, as this is an old type hopper. It has now given place to the type illustrated in No. 4, which shows the flanges tack-welded to the hopper. The tack-welds are so strong that it has been found unnecessary to weld the entire length of the seam. Rivets are only used on the hangers on this new type of hopper and according to Mr. Kush welding will be used in the future. In fact the majority of the hoppers he is turning out now do use welded construction here.

A concrete mixer drum is shown in No. 3. It has one longitudinal seam and two welded seams around the top and one at the bottom where the channel flanges are welded to the drums. The ends of the drum are also welded to these channel flanges, making the drum entirely welded with the exception of the gear which is riveted. Rivets are used here so that when the gear teeth are worn or broken the gear can easily be removed and a new one attached. This mixer drum is made of 12 gauge steel and on this type of work Mr. Kush uses 5/32-inch and 3-16-inch coated rods. An inspection of the inside of this drum shows that the mixer blades are also welded. Welding in tihs instance cut out more than half the cost of manufacture with riveting. One can readily understand that it was a difficult job to rivet the blades on the inside of the drum and also to rivet the channel flanges and ends so that they would be tight and rigid. Now the concrete leakage is entirely stopped.

Another piece of concrete equipment which is electric arc welded is shown in No. 5. This chute may be used for coal or concrete. Mr. Kush has made up a large number of these for use in both industries. The cross members are welded to the sides, giving great rigidity to the chute. Where one length of the chute is welded to the other length, a lap weld is made. That is, the upper section of the chute laps over the lower section on the top and it is welded clear across. Then the chute is turned over and where the lower part overlaps the upper part it is again welded, this time from the bottom. In this way you get a double weld and a nice, smooth joint which allows an uninterrupted flow of material. It is impossible for one of these chutes to ever fail because there are no bolts or rivets to shear off. There are no uneven or rough places in the chute to cause the concrete to clog.

In the illustration designated as No. 6 one can see the bottom side of the lower half of a concrete chute. This runs from the hopper to the work and the lower connection is also shown. There is a great deal of welding on one of these chutes. To take care of this work Mr. Kush has designed a special jig. These chutes are made in two sizes, 20 feet and 30 feet in length. The jig is designed primarily to take care of the longer chute but by placing a cross member in the jig the 20 ft. chute can also be easily handled. The fittings at the end of the chute are welded on and all of the cross members are also welded. The same lap weld type of construction is used in these round bottom concrete chutes as was described for the flat bottom coal chutes.

No. 7 shows the upper part of the same concrete chute, showing the upper connection which attaches to the hopper. This upper connection is also entirely welded and again you have an entirely leak roof piece of equipment, free from rivets and bolts, and thus giving great strength and rigidity.

Mr. Kush is now an enthusiast over the welding process. He diligently searches for new welding applications around his plant. From close observation one can see that his search has not been fruitless because every day rivets are giving way to welding. Where a joint was riveted yesterday it is welded today; where a new piece of machinery was ordered yesterday, the broken piece is welded today. Welding is in prominence everywhere in the Archer Iron Works and the company is now a great booster of the welding process.

Such enthusiasm is not based alone upon their own satisfaction regarding the ability of welding to solve their problems. They have great faith in welding, and this faith is proven every day. Every day one customer or another comments favorably up their new method of construction. The neater, leak proof jobs are selling more equipment and more satisfaction. Where an order for equipment was formerly nothing more than an order, now the filling of that order is always rewarded with a compliment from the buyer. It all just goes to prove that where manufacturers are willing to be shown, welding will not only show them how to do their work economically, but it will also help them to sell more of their products.

LINCOLN STEEL ACQUIRES KORO

The Koro Electric Corporation, Chicago, formerly manufacturer of Koro Welding Electrodes, has been purchased by the Lincoln Steel Company, 2320 W. 58th St., Chicago. The Lincoln Steel Company are distributors of the welding rods and wires made by the Page Steel & Wire Company and also of the steel and iron sheet stock made by the American Rolling Mills Company. The Lincoln company will manufacture the complete line of Koro wires and market them through dealers who handle welding equipment and supplies.

Gas Products Association Convention

ARRANGEMENTS have been nearly completed for the annual summer meeting and convention of the Gas Products Association. The meeting place is French Lick Springs Hotel, French Lick Springs, Indiana. The membership of the association includes about fifty plants manufacturing oxygen, acetylene and hydrogen gases and supplying them to the welding trade compressed in cylinders. A number of oxy-acetylene apparatus and supply manufacturers are represented in the association as associate members and a great many of the active members sell apparatus as well as gases, some of them manufacturing apparatus and others acting as distributors for manufacturers of standard lines.

It is evident from this description of the membership that in this group there is keen interest in the development of the oxy-acetylene welding and cutting processes. It has therefore become customary at the meetings of the Association to divide the program into two groups of subjects. One of these groups has to do with the problems of operating and managing gas producing plants and the other group is concerned with the uses for the product, that is with subjects pertaining to oxy-acetylene welding and cutting.

In this latter group, for this year's program two splendid papers have been arranged. Mr. H. E. Wetzell, engineer of the Smith & Oby Company, Cleveland, is to talk on the subject of pipe welding for the building contractor. Mr. Wetzell has contributed generously to the progress of pipe welding in the city of Cleveland and those who are working along the same lines will be able to get some valuable suggestions based on actual experience as a contractor in the plumbing, heating and ventilating industry.

Another recently developed field which offers immense possibilities is the making of general repairs with bronze. Mr. W. S. Swift, engineer of the American Brass Company, is expected to present a paper on this subject. Great strides have been made in the last few years in the application of the bronze filler rod for welding everything from heavy locomotive frames to slight cracks in thin sections. The references which have so far been published do not begin to indicate the great field of usefulness for this process.

Executive sessions and committee reports naturally bring out many subjects for discussion which are of particular interest to men who are all engaged in the same class of work. The members have always expressed themselves as being very much gratified by the help and inspiration received from these discussions.

Then there is the lighter note. French Lick Springs has an international reputation as a pleasure resort and plenty of time will be allowed to the members and guests to relax and make the occasion furnish pleasure and entertainment. The spot would not have been picked out for a summer meeting if it did not provide an excellent golf course because this is a favorite pastime of many of those who will be present. This year golf will be a strong drawing card because Mr. A. J. Russell, president of the Bettendorf Oxygen Company, and a prominent member of the association, recently joined the ranks of the Hole-in-One Club. The newspaper accounts give him credit for completing a 125 yd. hole with a single perfectly executed mashie shot at the Davenport Country Club. So far as is known Mr. Russell is the only member of the association to enjoy this distinction and it is certain that the golf fans who will be present will make a strong effort to accomplish the same feat and share honors with him.

The days for the convention are June 21, 22 and 23. It offers the members and invited guests three days crammed full of a perfect mixture of business and pleasure. Those who want to know what the proper proportions of these two ingredients are the result in three perfectly spent days should not fail to make their reservations and "join the bunch."

HOW WELDING SCHOOLS CAN BE HELPED

A little while ago a school in Los Angeles, California, decided to install apparatus for giving a course in gas and arc welding. The Los Angeles Section of the American Welding Society became interested in this school and offered its co-operation to help make the course successful. One of the first steps taken was to send a circular questionnaire to a large list of industrial firms in Los Angeles and vicinity in order to get first hand information regarding the qualifications of good welders from the employer's point of view. It was thought that from the answers to such a questionnaire those who were interested in the school would be able to form a most intelligent judgment of the requirements of a complete welding course and would consequently be in good position to advise the instructors regarding the contact of such a course. Following is a list of the questions included in the circular:

What type of industry are you in?.....

What operations or tests must a welder be able to pass before you will employ him?.....

.....

What must he be able to do to deserve promotion?.....

.....

In arc welding?.....

In acetylene welding?.....

What metals? .....

What dimensions? .....

What class of work?.....

Would you employ a graduate of a welding school who had had no practical experience?.....

How long a course should a welder of average intelligence be given? .....

What other information than actual operation of the torch or arc is required of the welder?.....

Add what other questions with answers to same that you think would be beneficial towards getting a good journeyman welder.

.....

The June meeting of the Los Angeles Section was held on June second. The members had an opportunity to listen to a talk by Mr. James W. Owens, of the Newport News Shipbuilding and Dry Dock Company. Mr. Owens is a nationally recognized authority on welded design and his subject was Stresses in Welded Design.

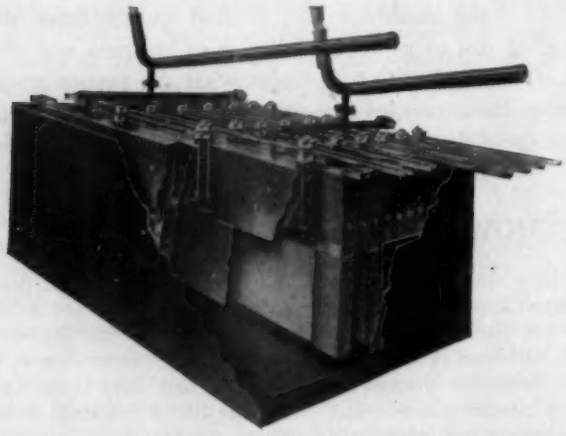
WELDING PLAYS IMPORTANT PART IN CONSTRUCTION OF ELECTROLYTIC OXYGEN-HYDROGEN PLANTS

Hydrogen for Synthetic Ammonia, Hydrogenation of Oil and Other Chemical Progresses

By Wm. F. McKay, Chief Engineer, International Oxygen Company

THE recent installation of a Knowles plant for the production of 1,750,000 cubic feet of hydrogen per day at Soulon, France, is of timely interest to the chemical industry in this country, in view of the numerous projects of large magnitude now in hand calling for a dependable supply of pure hydrogen at a low cost. This is the twenty-fifth of its kind built under the Knowles patents.

There are several types of electrolytic generators available for the production of hydrogen, all following the same basic principles. These consist of two or more electrodes, a container for the electrolyte, and one or more diaphragms for separating the oxygen and hydrogen. With these will be found such accessories a bus bars, electric terminals, insulators, water feeds, gas offtakes, indicators, etc.



Sectional View of Knowles Plant.

In comparing the relative merits of various generators emphasis should be placed on the choice of materials, simplicity of construction and assembly, durability of all parts and low cost of maintenance. The comparison should further include the electrical efficiency of the generator, as that is the prime factor affecting the power consumption, and, therefore, the cost of the gas produced.

The Knowles generator was developed by Mr. A. Edgar Knowles, chairman of the International Electrolytic Plant Co., Ltd., of Great Britain, as a result of extensive experimental work combined with over thirty years of practical experience in this field.

Basically this generator is of the multipolar type, consisting of a tank containing the electrolyte in which are suspended alternate anodes and cathodes, each covered by an individual collecting bell with an asbestos diaphragm separating the electrodes. Alternate plates in each generator are connected in parallel, and copper links at both ends of the generator couple each set of electrodes in series with those of opposite polarity in adjoining generators. The number of generators coupled in series in any one battery will depend upon the supply voltage available, and the number of bells assembled in each generator will depend upon the amperage that can be supplied to produce the volume of gas required.

Each electrode and collecting bell is a complete unit in itself, but all the bells in any one generator are welded together into a solid block and may be lifted bodily from the tank complete with all connections in one operation.

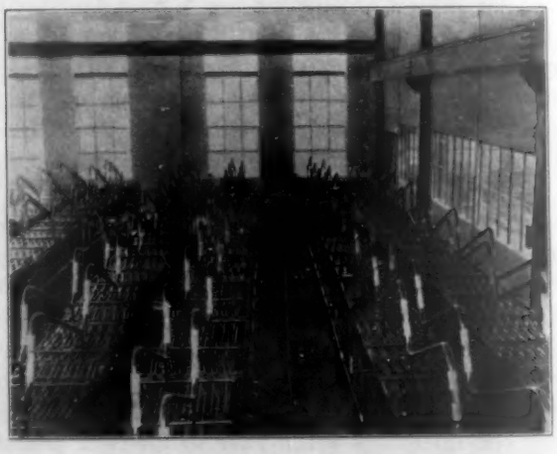
The materials entering into the construction of this generator have been carefully selected with a view to long life and consist of steel, asbestos, ebonite and copper. Its inherent simplicity is perhaps one of its strongest points. This has been accomplished by the use of the unit system of construction and the elimination of rivets, bolts, flanges, gaskets, bushings, intricate chambers, castings, and similar weaknesses.

Current is supplied to the electrodes by staggered lead-ins, to which they are welded, with terminals on the tops of the bells. Oxygen and hydrogen are carried off from the bells by two manifold lines, one for each gas, running across the top of the generators, and connecting with common offtake pipes for each battery. These are specially constructed so as to immediately return to each individual generator any electrolyte carried off by the gases generated therein, thus insuring operation at a consistently high efficiency. An automatic gravity feed system supplies distilled water to each bank of generators and maintains a constant level of electrolyte independent of the rate of gas production.

Figure 1 shows the construction details of the Knowles generator. In each electrolyte tank are a multiple number of electrodes, each welded to a lead-in, and suspended by means of it from an individual collecting bill. The lead-in is insulated from the sealing tube by an ebonite tube, and by a surface insulator. A series of copper connectors connect the two lead-ins on the same electrode together to insure an even distribution of current, and terminate at the bus-bars paralleling anodes and cathodes. The oxygen and hydrogen from each collecting bell is led off by means of manifold pipes to its respective offtake provided with insulating tubes between generators. The asbestos diaphragms are also shown. The skirting surrounds the entire block of bells and forms a stand on which it may rest when lifted from the tank for examination.

There are several distinctive features contributing to the high efficiency of this generator and these are: low current density and minimum voltage drop on all conductors and joints, total absence of current carrying joints in contact with electrolyte; even distribution of current, and therefore even evolution of gas over the entire surface of the electrodes, thorough and lasting insulation of electrodes, offtake pipes, feed water pipes, and electrolyte tank; in short, every assurance that all of the current applied to the generators is utilized in electrolysing the water.

Prolonged tests of Knowles generators have shown a consistent average purity of over 99.8%. This high initial purity is an inherent feature of the construction of the generator and constitutes the most positive proof of its safety. It is due largely to the low depth of electrodes and the large volume of electrolyte between them. Other features of merit in this respect are exceptionally low gas content in the electrolyte, free circulation of solution under equal pressure, automatic atmospheric release, independent unit construction, and total absence of intricate chambers or restricted passages. Where desired auxiliary purifiers can be supplied to increase the purity to practically 100%.



Knowles Installation at Toulon, France.

The Knowles generator is available in a wide range of sizes varying from 166 amperes to 12,500 amperes. Each size may, of course, be operated efficiently at any current density desired up to its maximum, the hydrogen output being directly proportional to the current applied. As is the case with all electrolytic generators the highest electrical efficiency is obtained at the lower current input, and the most efficient rate of operation will depend upon the cost of power. Thus, when power is available at the

lowest rate as in off-peak periods, the generators can be operated at maximum current input. The Knowles plant can be started or shut down by the mere throw of a switch and operated continuously or intermittently as may be found practicable without appreciable loss of efficiency.

While Knowles patent electrolytic generators are being installed primarily for the production of high purity hydrogen at low cost, each installation will automatically produce oxygen 99.5% pure as a by-product in the usual ratios of one cubic foot of oxygen to two cubic feet of hydrogen. Oxygen of such high purity can be readily marketed in many localities and frequently brings sufficient income to cover the entire cost of producing the desired hydrogen and even yield a substantial profit in addition.

The International Oxygen Company, Newark, N. J., well known as pioneers in electrolytic cell developments in the United States, holding numerous patents in the field, have now taken over the exclusive distribution and manufacture of the Knowles Generator for the United States and Canada.

INFLUENCE OF DESIGN OF STRUCTURES IN WELDING

The most interesting paper has just been read before the Institute of Civil Engineers, London, by J. N. Reeson, in which he dealt with the influence of electric welding on the design of structures, and described its application to the repair and construction of gasholders and other plants owned by the Metropolitan Gas Company of Melbourne. He described the advantages of electric welding over riveting as greater security, simplifications of design in the office, and economy in the workshops and field.

To obtain informatoin on various points on which doubt has been expressed, such as the strength of electric welds in actual practice, the effect of corrosion on the weld itself and on the welding deposit, and the cost in comparison with riveting, some hundreds of tests were made, not fewer than six of each type of joint being tested to destruction. The tests were analyzed by the designing staff in order that the requirements of welded joints should be known. As a result the size of electrode, number of runs, and lineal length of electrode to be deposited per unit length of weld are specified on the drawings. To measure efficiency elaborate log sheets were evolved to check these important items; as covered electrodes only are used, it is essential that this valuable material should be carefully accounted for. The most important factor is the training of the designing staff; welding is not a mere substitute for riveting. The use of welding simplifies design very considerably. A great saving may be effected in weight of material, the whole structural workshop routine is changed, and the use of jigs is a necessity.

The causes which led to the adoption of welding by the author's company date from 1916, when an extensive program of gasholder construction became necessary in Melbourne. A large gasholder, containing upwards of 2,000,000 cubic feet of gas collapsed in 1920. The thin sheeting of the crown ripped off close to the curb like the lid of a tin, and the released gas ignited and burned in a mass high above the holder. Investigation showed that the fracture of the thin sheets was invariably at the lap of the sheets and not through the rivets, as might have been expected. The author decided to substitute welding for riveting for joints of thin sheets, which, in the damaged holder, showed signs of serious internal corrosion. The exterior of the sheets had been well preserved, there was no evidence of weakness, and the holder was of the type usual at the period of its erection. The author decided to increase the strength of the sheets of the new holder and of the structure generally. Extensive experiments were made in the company's work shops and at the Melbourne university, and it was evident that there would be no difficulty in obtaining a joint at least as strong as the sheet, as compared with a 55 per cent strength of the single riveted joint.

The new holder has many novel features; the vertical stays are much stronger than is customary, and all the sheeting is $\frac{5}{16}$th inch in three lines, the crown curb cups and dips and outer lift curb being, of course, much stronger. The welding of the side sheets at first presented great difficulty, owing to lack of knowledge of the behavior of the sheets under local heating by welding and of the distortion caused by contraction. The methods used in erection had to be modified to overcome the difficulties as they arose. The outer lift was erected first and the middle and inner lifts followed, but later experience enabled the author to devise an entirely different method, whereby the erection is much simplified. The welding of the crown sheeting followed, and no difficulty was experienced in the overhead welding of these sheets. Both sides of the lap were welded, although tests showed that a joint welded on one side would be stronger than the single riveted joint. No tape was used, and this in itself is a great advantage, especially in hot climates where the tape perishes. In the length of seams—14 to 15 miles—only about half a dozen "weeps" were observed on testing.

The design and construction of the new gasholder of 2,750,000 cubic feet was then proceeded with. This is 163 feet in diameter, and 144 feet high, and is exclusively electrically welded. The original tank was increased in depth by a reinforced concrete extension of original design. This holder has four lifts and the framing consists of 16 steel standards 144 feet high, with five tiers of horizontal struts and wind bracing. The floating bell embraces many novel features, and the whole structure, weighing 760 tons, was fabricated and erected in ten months. On testing not a single leak was discovered.

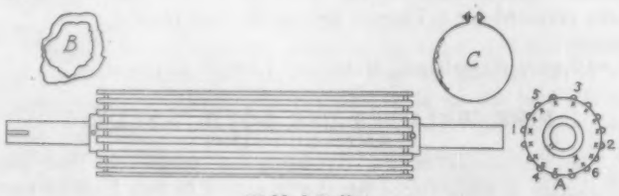
In the last of the two other gasholders constructed a radical alteration from existing designs has been carried out, in that the framing consists of tubular columns and tubular horizontal struts. Ingenious methods of testing these columns—which are 145 feet high—and struts were adopted, and the new method enables a great saving of material to be effected.

Other welding work consisted in the placing of strong reinforcing nets over the crowns of all old gasholders to prevent the fracture of sheeting. A 3,000,000 cubic feet set of condensers, and a set of steel purifiers of similar size, were fabricated and erected at a cost of £13,000 ($65,000) against £22,500 ($112,500) for a similar set erected a few years before. Other plant includes tar extractors, ammonia concentrating plant, liquid pumping plant, steel chimneys, and a bridge consisting of a gas main, 24 inches in diameter and 90 feet long, which has been subjected to several serious floods witoout damage.

WELDING MAKES CHEAPER AND BETTER ROLLERS

By Chas. Haeusser

A progressive concrete block manufacturer who builds, improves and repairs his machinery by welding shop methods, recently brought into our shop two pieces of 2 foot shaft 6 feet long, 4 cast iron collars and 4 boiler plate discs 10 inches by ¼ inch, together with thirty-two 1 inch half round iron bars 4 feet long.



Welded Roller

He ordered this material made into two squirrel cage rollers. We preheated the discs and removed the scale. Then the collar was fastened to the discs with a fillet bronze weld. After welding the discs to the shaft it was necessary to hold 16 bars at A for welding at X in the order shown on the diagram, 1-2-3-4-5-6. This prevented warping of the discs by giving equal tension to the bars. Four rubber bands were sliced from a discarded inner tube and slipped around the bars to hold them in place until they could be more securely fastened by iron clamps as shown in C. The oxy-acetylene process and nickel steel welding wire was used, to make this job a success.

ONE THERMIT WELD SAVES 32 THOUSAND DOLLARS PLUS

By H. D. Kelley*

During the severe blizzard, the first of March, 1926, a Thermit weld was made on the housing of an Allis-Chalmers stone crusher for the Casparis Stone Company, of Logansport, Ind.

There were two cracks in this housing and the cracks were located in a pit 22 feet underground. One of the cracks was 5 feet long and 1,200 pounds of railroad Thermit were used in making the weld, while the other crack was 8 feet 6 inches long and 1,500 pounds of railroad Thermit were used. The procedure for making this Thermit weld was first to see that the parts to be welded were separated. This was done by cutting the gap and then applying a wax matrix or pattern the shape of the finished weld. A sheet iron mould box was then placed entirely around the broken part of the gap. Thermit moulding material, which is a mixture of silica sand and plastic clay, was next rammed upon the parts to be welded. The proper heating gates, pouring gate and risers were placed in the sand as the mould was rammed up.

After completing the mould, the crucible was placed in position. The capacity of this crucible was 1,500 pounds of Thermit. A heating torch was then applied to the heating gate. This melted out the wax, dried the mould and brought the parts to be welded up to a temperature of about 1,500 degree Fahrenheit. Thermit was next placed in the crucible, the heating gates were then plugged up and the Thermit ignited by ignition powder. The reaction of the Thermit took about one minute. The plugging material at the bottom of the crucible was then tapped. This allowed the Thermit steel to take the place which had been occupied by the wax and amalgamate with the original or parent metal. After the Thermit steel was poured into the mould it was allowed to cool for fifteen hours. Then the mould was stripped and the gates and risers were cut off. This completed the weld, as there was no machine work necessary on this casting.

This work was completed in six days, at a total cost for the complete weld of $2,736.44. The total cost of materials was $1,898.52, while the total cost of labor was $837.92. The cost of a new casting would have been about $35,000.00, and it would have taken approximately 90 days for its delivery and installation. The cost of shutting down this plant for 90 days would have been enormous, but not figuring this saving, the net saving between the cost of a new casting and the cost of welding amounted to $32,263.56. The cost was considerably more than it should have been, because prior to calling The Metal and Thermit Corporation in on this job the Casparis Stone Company had given it to an electric welding company. They prepared the crack for welding in the usual way, that is by v'ing it out, but after starting the work they decided, that owing to the large size of the parts to be welded a Thermit weld should be used. However, they had already made a double "V" and this necessitated the use of an excessive amount of Thermit which would not have been the case if the weld had been prepared for a Thermit weld in the first place.

Thermit Department, Metal and Thermit Corporation.

PIPE WELDERS USE BOTH WELDING AND CUTTING

The usefulness of the oxy-acetylene process to the pipe fabricator is emphasized by the fact that in this kind of work there is a constant demand for both welding and cutting operations, both of which allow attractive savings to the user. The accompanying photographs, forwarded by the Purox Company, show the use of their equipment for both welding and cutting on pipe work. The first is a forceful illustration of the savings effected at the Los Angeles shops of the Pacific Fruit Express Company, where the pipes of ammonia condensers are now being welded. The first reason for welding the pipes is because they have found that gaskets rot out in fitted joints, causing leaks in the line (leaks in an ammonia line are expensive), and no end of trouble, whereas the welded line is as permanent and free from trouble as any continuous section of pipe can be. Another reason for welding is found in the reduced cost, as they have determined that the cost of a fitted joint is $7.20 per fitting, plus the labor of installation, compared to the cost of $1.50, including labor on a welded joint. In the photograph the ammonia condensers shown in the foreground are welded, while the section in the rear is made up of fittings. The second photograph shows a Purox circle cutting torch and a standard cutting torch in use at the shops of

Pipe Welders Use Both Cutting and Welding.

the Los Angeles Gas & Electric Company cutting flanges for brazine on dirty traps. It will be recalled that the brazing of gas main joints by public service companies has been the theme of many articles in the trade press during recent years, but not much has been said concerning the important part played by the cutting torch in this work. These two money saving tools work together in a great many different types of plants, and in tank work and pipe work the combination is almost indispensable.

JUNIOR MODEL OF THE MANN MASTER CONTROLLER

The Electric Welder Controller Company, Pittsburgh, Pennsylvania, manufacturers of the Mann Master Controller for electric arc welders, have just put on the market a junior model of their controller which is smaller in size than the regular model and sells at a lower price. This smaller model is recommended especially for use in connection with machines which are operating on thin sheet metal.

J. W. DUNHAM JOINS KEITH DUNHAM ORGANIZATION

J. W. Dunham, better known as Jimmie, the son of M. Keith Dunham of the Keith Dunham Company, Chicago, was graduated this month from Massachusetts Institute of Technology, and immediately after graduating proceeded to Chicago to accept a position with the Keith Dunham organization. Jimmie has devoted considerable study to the subject of compressed gases and is familiar with the operation of acetylene and oxygen plants. It is reported that his first duties will keep him busy for awhile at the acetylene cylinder plant maintained by the organization in Milwaukee, Wisconsin.

INTERESTING WELD REPAIR OF LARGE CASTING

The casting illustrated is a punch press which was broken into three parts, the breaks extending through both bearings, which necessitated a repair that would allow machining. The welder used the electric arc process with a Koro special black coated mild steel rod, and no preheating was done. In order to preserve the

Welding Put this Punch Press Back in Service.

alignment it was necessary to build a wooden crate around the machine. After the press was welded it was machined in a boring bar, and since the bearings were solid cast iron, this meant the operator must take pains to produce a soft weld. In this case it is reported that no difficulty was experienced in machining flush with the original cast iron surface.

NEW IMPERIAL ACETYLENE GENERATOR

The Imperial Brass Company, of Chicago, recently announced a new acetylene generator called the "Type M." This new generator is of the portable type with 50-pound carbide capacity and is somewhat simpler in construction than the Imperial Type A generator which is a stationary machine working on the same principle. The new generator is said to operate at any desired pressure from one pound to fourteen pounds by adjustment of pressure regulator. Each charge of fifty pounds of carbide will produce approximately 250 feet of acetylene. The generator itself weighs 180 pounds empty, is 55 inches high and the diameter of the base is 28 inches.

PUROX COMPANY NOW HANDLES STOODITE

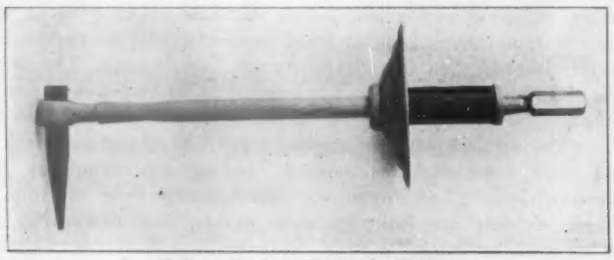
Announcement has been received from the Stoody Company, Whittier, California, that arrangements have been made to supply Stoody Welding Rods and Stoodite through the distribution facilities offered by the Purox organization. The latter company has branch offices in a great many important cities from California to New York and therefore a selling organization is provided which makes these metals readily available in practically every section of the country.

BURKE WELDERS HAVE MICROMETER ADJUSTMENT

Bulletin 133 of the Burke Electric Company, Erie, Pennsylvania, manufacturers of the Burke electrict arc welders, makes a special feature of micrometer adjustment of the welding current in their variable voltage genrator The regulation of the current is accomplished by turning a hand wheel on the generator frame, which shifts the position of the main brush. An infinite number of current values is thus made possible. An indicator on the generator brush arm is calibrated for the various current values under actual welding conditions. Burke welders are supplied as single operator machines, two operator machines and portable machines. Constant potential generators are also built by this company to meet requirements which call for both carbon welding or cutting, or when it is desired to have a number of operators working in multiple from the same machine.

VULCAN CARBON ELECTRODE HOLDER

The Fibre Metal Products Company, Chester, Pennsylvania, are manufacturing a new product known as the Vulcan Carbon Electrode Holder. This holder is especially adapted for foundries, rail welding and bonding and for all heavy duty work where carbon arc welding is used. The manufacturers



Vulcan Carbon Electrode Holder.

have had in mind the troubles occasioned by overheating of electrode holders in carbon arc welding and claim for their product that it will not overheat and will stand up under the most severe conditions. Although it is light in weight and easily handled, it is very sturdy. The standard sizes are for 200, 400 and 600 amperes.

"SHOOT A LIGHT"

The Stevenson Distributing Corporation, of New York City, some months ago, purchased, as a business, Shoot-a-lite, the safety gas lighter. While that corporation has thus far devoted most of its efforts to the cultivation of the manufactured gas companies and their household consumers, it has not altogether neglected the welding field, in which it is rapidly finding favor, and particularly with those welding concerns which deal in equipment of the better quality.

Shoot-a-lite is ruggedly made in the form of a flat pistol, is unusually durable and especially easy to handle. It is very convenient for carrying in the pocket or on the belt. It does not scatter its sparks but rather shoots them in volume, directly to the desired point. Having something of the grip and action of a revolver, it makes a strong appeal to a he-man.

The manufacturers use the slogan: "Everybody loves to shoot a light with Shoot-a-lite," and there seems to be some foundation, in fact, for the statement.

CLEVELAND CONCERN MAKES ARC WELDERS AND SOLDERS

Announcements received from the Aluminum Fix Company, Cleveland, Ohio, indicate that this firm manufactures apparatus and supplies not only for repairing but also for electric arc welding operations. One of their products is called the new process "Aluminum Fix." This preparation is used for the repair of broken and cracked aluminum parts and can be applied either with the gas torch, lead burning torch, or a gas

or acetylene torch. Another product is the new process "Iron Fix," which is particularly recommended for repairing scored cylinders but can also be used to repair cracked engine blocks, water jackets, cylinder heads, boiler sections, etc. When used for repairing scored cylinders it is claimed that it permits the use of the same pistons and rings after the repair has been made. The same concern manufactures a new art welding transformer called the "Supreme." The machine is constructed so that 56 different arc variations, some of these are for use with the intermittent arc welding process and others for straight welding. The transformer is enclosed in an all welded steel cabinet and the panel is protected by a steel door which is kept closed so that there is no occasion for the operator or anybody else getting in contact with the switch except for the purpose of changing the voltage adjustment.

HANSEN ARC WELDER HAS NO EXTERNAL STABILIZER

An outstanding feature of the Hansen Arc Welder, which is manufactured by the Northwestern Manufacturing Company, Milwaukee, is a special disposition of the commutated pole winding so as to make it function both as a commutating winding and a stabilizing winding. Some turns of the commutating pole coils have been extended to and completely imbedded in the adjacent main pole flanges. The portion of the commutating winding, thus extended and surrounded by laminations, functions in the two-fold capacity commutating and stabilizing winding. The stabilizing effect has thus been obtained without adding any windings to those ordinarily employed in commutating pole machines. These welders are built in two ratings, one driven by a 10-horsepower motor with a current range from 60 to 350 amperes and the other driven by a 15-horsepower motor with a current range from 90 to 400 amperes.

DESIGN OF OXWELDED EQUIPMENT

(*Continued from page* 37)

a severe proof test 419,598 times out of 419,600. No wonder it is acceptable where the safety of human life depends upon its strength.

This is what "design" of welding will do, in the largest meaning of the word "design." Design not only the individual joint, but correct design for each step in its construction. Such designs cannot fail.

RESEARCH IN THE WELDING INDUSTRY

(*Continued from page* 32)

and do some high power experting for them. I got there one morning but the problem had worked itself out in Bill's mind over night. He said to me—"Let's make the weld so much stiffer than the adjacent section that bending will always occur in the original section, rather than in the weld." Now isn't that simple?

Bill solved the problem, because he wanted to serve that prospect and help him do what he wanted to do. The research is still going on to find practical means of getting a ductile weld, but Bill's method gives substantially the same RESULTS as if it were ductile—and it enables people to do SUCCESSFUL JOBS.

Old Pops McGrew pinned his faith on the Motive Power which drives men to great and useful achievement. He knew how to release the great flood of intellectual power that is latent in the minds of common men. He got results.

NEWS OF THE WELDING TRADE

Mr. Dewey Maley has joined the staff of the Central Steel and Wire Company, Chicago, as demonstrator and salesman of the Swedox line of welding rods and wire. Mr. Maley takes the place of Mr. J. E. Styrmoe, who recently left his position with the above company.

Mr. Stanley Winger of the Standard Gas Products Company was a visitor in Chicago June 10th.

The Joseph T. Ryerson organization, Chicago, Illinois, has recently taken the Chicago agency for the Stable Arc welding machines made by the Lincoln Electric Company, Cleveland, Ohio. Mr. Ira B. Yates is in charge of the sales.

I. D. Greene has joined the organization of the Bettendorf Oxygen-Hydrogen Company, Bettendorf, Iowa, as service representative. Having had wide experience in large scale operations of welding and cutting his attention will be devoted to looking after the welding and cutting problems of the customers of the Bettendorf plant.

Mr. F. W. Clifford of the Victor Oxy-Acetylene Equipment Company, San Francisco, California, visited Chicago last week and announced the opening of a new office of this company at 418 South Fourth Street, St. Louis, Missouri. The manager of the St. Louis office is Mr. A. Henry.

Announcement has been made that the Oxweld Railroad Service Company is planning to eret a one-story welding shop on Green Avenue, New Haven, Conneticut.

According to a recent report the Kansas Acetylene Gas Company, Wichita, Kansas, plans to start the manufacture of acetylene gas for industrial plants in the near future. Two warehouses and a plant have been completed at 602 East 29th Street.

Air Reduction Sales Company has announced the appointment of J. M. Harkins as district manager in the Virginia district, with headquarters at Richmond, Virginia. Mr. Harkins has been connected with the Davis-Bournenville Company and the Air Reduction Sales Company in the central west for a number of years.

Glenn Forrester, who formerly operated a welding shop at Marion, Indiana in partnership with Mr. W. F. Gehle, writes that they have opened up a shop in Niles, Michigan.

W. A. Owens, well-known in the Chicago district as a service man and demonstrator of welding rods and wire, has recently joined the sales organization of the C. H. Hollup Corporation, Chicago, Illinois.

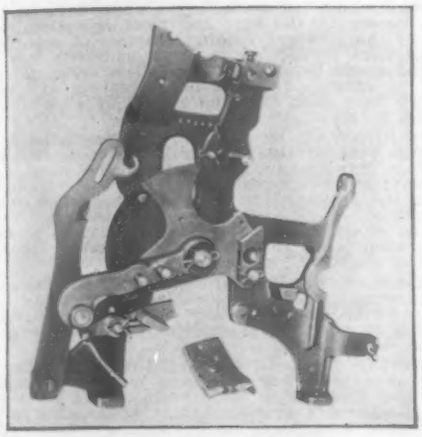
The Gibb Welding Machines Company, Bay City, Michigan, broke ground on June 10th for an addition to their factory, which it is said will more than double their present floor space.

NEW G-E SOLDERING IRON

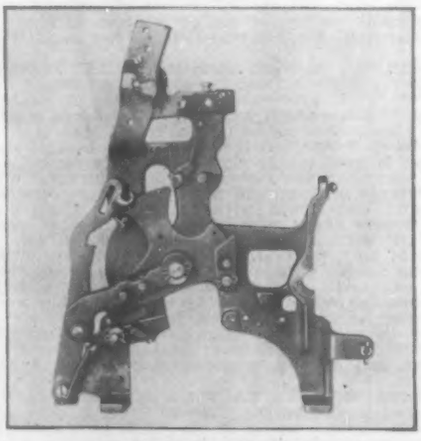
The General Electric Company is now marketing a new soldering iron of light construction, designed to heat up quickly. This iron is made in standard sizes ranging from ½-inch to 1¼-inch tip.

Power consumption ranges from 70 watts for the smaller iron for light and intermittent use, to 350 watts for the larger size on heavy duty. The irons for heavy duty are provided with radiating stands for the purpose of maintaining the iron at the correct operating temperature when temporarily not in use. The rapid rate of initial heating is brought about by unusually good heat conduction between the heating element and the copper tip. Heat from the tip is prevented from reach-the handle by means of a special mechanical construction between the two, this being in the form of a spiral made from a steel rod. This also provides a rigid connection between the handle and tip.

TOBIN BRONZE WELDING
makes emergency repairs permanent



A bad break in the cast iron parts of an automatic machine—



—welded with Tobin Bronze without dismantling

WHEN a break occurs in an automatic machine, the shop is often confronted with a loss in production while a new part is being obtained. This may take days or even weeks. In the meantime every effort is made to keep the machine in operation. Even makeshift and temporary repairs are often resorted to, to prevent a shutdown.

Tobin Bronze Welding by the oxy-acetylene process offers a most effective solution of such difficulties. It provides the element of speed demanded of emergency repairs and at the same time it makes the repair permanent. It prevents loss of production, and saves the cost of new parts.

The photographs show a typical example of a permanent repair made quickly with Tobin Bronze. Since extensive pre-heating was not required, dismantling was unnecessary. The low welding temperature of 1650° F. also prevented shrinkage and made it possible to restore the broken parts to their original alignment.

Most important of all, the repair is permanent and the weld is stronger than the original cast iron.

Tobin Bronze Welding Rods, exclusively an Anaconda product, are made solely by The American Brass Company, and "Tobin Bronze" is stamped in the metal.

THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

TOBIN BRONZE
REG. U.S. PAT. OFF.
WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT

Current Welding Literature

LO-HED HOISTS—A circular distributed by the Stulz-Sickles Company, 121 LaFayette Street, Newark, New Jersey, which illustrates and describes a line of ½ ton to 1 ton hoists, calling particular attention to the fact that it operates with minimum headroom. The complete line includes hoists with capacities from 1 thousand to 24 thousand pounds.

WELDING WIRE CIRCULAR—The Lincoln Steel Company, Chicago, is sending out an illustrated circular describing Page-Armco processed welding wire and electrodes. The circular is printed in two colors and discusses the outstanding features of this line of filler materials.

DESIGN OF OXWELDED EQUIPMENT, by E. E. Thum—Some examples of welded construction to illustrate the increased efficiency of the welding process when the work is especially designed for welding.—Acetylene Journal, June.

OXY-ACETYLENE WELDING OF SHEET ALUMINUM, by Joseph W. Meadowcroft—A new method of welding aluminum sheets to replace the old method of flanging the edges. The two sheets are placed in contact and a flux coated aluminum rod is laid over the joint.—Acetylene Journal, June.

REGULATIONS FOR INSTALLATION AND OPERATION OF GAS SYSTEMS FOR WELDING AND CUTTING—A reproduction of the regulations of the National Board of Fire Underwriters, as recommended by the National Fire Protection Association.—Acetylene Journal, June.

ELECTRIC WELDED CONSTRUCTION, by James Caldwell—Paper read before the Institution of Welding Engineers, detailing the steps which need to be considered in the design of assemblies for electric welding.—Welding Journal, London, May.

WELDING FACTS AND FIGURES, by D. Richardson and E. W. Birch—Introduction to a new handbook for welding engineers by these authors. The purpose of this book is to collect as much information as possible and corporate into it the data and results of numerous experiments and researches so that all of the work of this kind which has been done will be at the disposal of the engineers in the welding industry.—The Welding Journal, May.

LE GRIX HARDNESS TESTER—Description of a simple device for testing the hardness of metals. The instrument holds the pieces to be tested in a vice which presses a steel ball into the metal. The hardness is determined by measuring the diameter of the indentation.—Revue de la Soudure Autogene, Paris, March.

TYPES OF WELLS ON STEEL SHEETS—Reproductions of photographs of 17 welds on sheets of different sizes, with comments on it, showing what indications of the quality of the weld can be obtained by an examination of the surface.—Revue de la Soudure Autogene, Paris, March.

THE MOST FAVORABLE ACETYLENE PRESSURE IN OXY-ACETYLENE TORCHES, by R. Granjon—A summary of the studies made by oxy-acetylene engineers in Europe on the effect of acetylene pressure. The author points out that in practice each case is a special case and that many comparative tests have been made with high medium and low pressures to determine the relative efficiency of the apparatus. He points out the importance of having acetylene arrive to the torch in sufficient quantity and indicates that this is more important for the efficiency of the apparatus than the pressure itself.—Revue de la Soudure Autogene, Paris, March.

HARMFUL EFFECT OF EXCESS ACETYLENE IN THE FLAME, by A. Des Granges—In spite of the fact that operators are instructed to maintain a neutral flame it is not at all uncommon to find them welding with a carbonizing flame. The two principal reasons why a carbonizing flame should not be used are first that it causes a waste of fuel gas and second that it introduces carbon into the weld. It is a simple matter to make tests which will illustrate the harmful effect of carbonized metal in the welded seam.—Revue de la Soudure Autogene, Paris, March.

THE FATIGUE OF METALS, by P. Hollard—A description of the tests made by the A. O. Smith Corporation to determine the efficiency of arc welded penstocks.—Revue de la Soudure Autogene, Paris, March.

THE POSITION OF THE LINE OF WELD, by P. Hollard—A study of the conditions which govern the design of a weld so as to give the greatest strength with the least amount of welding. The service which a welded joint will give depends not only on its good execution, but also on the nature of the stresses to which it is submitted. Illustrations of a few designs which have greatly increased the efficiency of welded joints.—Revue de la Soudure Autogene, Paris, April.

BLOW HOLES IN BRONZE WELDING, by A. Des Granges—Bronze welding does not offer special difficulties, but very often if the work is not done by an operator who knows how to weld this metal the weld will be full of blow holes. To avoid this condition it is necessary to keep in mind that above a certain temperature the bronze will boil over, but if it is allowed to cool slowly enough blow holes will not be formed. Good solid welds can be obtained by carefully following the proper technique.—Revue de la Soudure Autogene, Paris, April.

AUTOGENOUS WELDING IN METALLIC CONSTRUCTION, by C. F. Keel—A discussion of the possibilities of replacing riveted structures by welded structures, with illustrations of several types of joints which can be welded. Welded structures can be made 10 per cent lighter than riveted structures of the same capacity.—Revue de la Soudure Autogene, Paris, April.

RAIL BOND WELDING INSTRUCTION POSTER—An instruction poster describing the difference between the steel metallic and the copper metallic arc welding process, and illustrating methods of applying different types of arc welded rail joints. The poster is intended as a guide for welders responsible for the installation of rail bonds. It is published and distributed without cost by the Ohio Brass Company, Mansfield, Ohio.

OXY-ACETYLENE BLOW PIPES EXTENSIVELY USED FOR SHIP WORK, by H. G. Edwards—Illustrations and descriptions of a variety of applications of the oxy-acetylene welding and cutting torches to ship work. Both processes are much in demand not only for repairs, but also in connection with the fabrication of modern ships.—Marine Engineering, June.

METAL CUTTING WITH OXY-ILLUMINATING GAS, by F. P. Wilson, Jr.—Action of metal cutting torch. Design of a new torch made especially for the use of illuminating gas and comparison of illuminating gas and other fuel gases. Advantages of the new type of torch.—General Electric Review, June.

THE STEEL WORKERS NEEDLE AND THREAD, by [illegible] L. Warner—A short discussion of the use of arc welding in steel mills. Examples of repairing and building up operations. Some of the savings which have been made by welding.—General Electric Review, June.

RESEARCH THE BEACON OF PROGRESS IN ARC WELDING, by H. M. Hobart and W. Spraagen—A discussion of the possibilities for research work in the arc welding industry.—Journal of the A. W. S., May.

SOME UNSOLVED FUNDAMENTAL CAUSE OF WELDING PROBLEM, by S. W. Miller—The neutral welding flame; the strength of welds at high temperatures, the non-destructive tests for welds; development of high strength welding rods; procedure control; best base metals for welding.—Journal of the A. W. S., May.

WELDING IN THE STRUCTURAL FIELD, by J. H. Edwards—The structural steel material used, the welding operation, shop and field operations costs. Some of the questions which have not yet been answered to the satisfaction of the structural trade.—Journal of the A. W. S., May.

HOW TO INVESTIGATE WELDED TANKS, by H. L. Whittemore—It is necessary to work out a carefully planned investigation if we are going to determine the best and most economical way to fabricate tanks by the different welding process. A great deal of investigation has been carried on in other countries and the results of their work should be carefully studied in order to avoid unnecessary waste of effort. Previous investigations of welded tanks in this country have been much on the hit or miss order.—Journal of the A. W. S., May.

WELDED CRANE RUNWAY, by A. F. Davis—Description of all welded crane runway built by the Modern Engineering Company for the Coplay Cement Manufacturing Company. This welding job called for 1800 linear feet of continuous bead and 2035 feet of intermittent welds on the girders. On the supporting frames there were 596 feet of continuous bead and 403 feet of intermittent beading. The application of welding on this runway brought about a material saving in shop labor costs and also a saving of steel materials.—Journal of the A. W. S., May.

DESIGN OF OXWELDED EQUIPMENT, by E. E. Thum—In order to use the welding process at its highest efficiency it is necessary that joints be designed especially for the welding process instead of attempting to use welding on joints designed for other methods of assembly.—Journal of the A. W. S., May.

ELECTRIC WELDING THE NEW STAINLESS STEELS, by C. J. Holslag—The chemical industry is very much interested in non-corroding iron and steel alloys for containers and machinery parts. In the fabrication of such equipment is possible to use arc welding to very good advantage, but the nature of these alloys makes it necessary to be very careful in the development or procedure.—Journal of the A. W. S., May.

ARC WELDED JIGS AND FIXTURES, by E. Vom Steeg, Jr.—When arc welding is used for quantity production it pays to make up jigs for holding the work during the process of assembly. The jigs themselves are made up by the use of commercial structural shapes which are arc welded together.—Journal of the A. W. S., May.

WELDING AS APPLIED TO THE AUTOMOTIVE INDUSTRIES by Joseph W. Meadowcroft—A history of the development of methods for using the welding process in automobile construction. Some of the early difficulties which were encountered and methods used in overcoming them.—Journal of the A. W. S., May.

ARC WELDING IN G-E FACTORIES—A 28-page booklet showing how arc welding is used in the General Electric factories for manufacturing and miscellaneous processes. Tank manufacturing, factory furniture, fixtures, salvage and repairs, and structural steel work. Published and distributed without cost by the General Electric Company, Schenectady, New York.

X-RAY TESTS OF WELDS REVEAL SOME DEFECTS, BUT NOT ALL—Results of an investigation carried out by the Watertown Arsenal and the Union Carbide and Carbon Research Laboratories. The X-ray examination of fusion welded joints is of particular value in revealing voids and oxide inclusions, but misses defects due to insufficient fusion.—Power, May 25th.

SMITH-O-GRAMS—Monthly publication of Smith Welding & Equipment Corporation. The May issue contains articles on all welded railings, cast iron cutting, ornamental iron work and the use of carbide sludge.

EFFECT OF SURFACE MATERIALS ON STEEL WELDING RODS—24-page booklet issued by the Chicago Steel & Wire Company, Chicago, Illinois. A discussion of the effect of metallic and non-metallic surface materials on the working qualities of gas filler rods is followed by a similar discussion of the effect of surface materials on electric welding wire; then there is a technical discussion explaining the effect of surface materials from the standpoint of some of the scientific laws governing the metallic arc. Catalog material is included to describe the complete line of Weldite welding wire, giving their specifications and tables showing their comparative qualities.

THE MODERN DEVELOPMENT OF OXYGEN PRODUCTION FROM AIR, by C. R. Houseman—Paper read before the British Acetylene and Welding Association telling what the British Oxygen Company is doing in the matter of producing pure oxygen gas.—Industrial Gases, London, March.

INFLUENCE OF OXY-ACETYLENE CUTTING ON STEEL FOUNDRY PRACTICE, by R. W. Thomas—The oxy-aectylene process has made possible a decrease in the time required to produce a given tonnage of castings and improvement in the quality of castings, a reduction in the percentage of defective castings, a saving in the expense of crane service and increased latitude for engineers in designing steel castings.—Industrial Gases, London, March.

THE EXPANSION PROBLEM, by W. T. Funston—An explanation of the nature of the contraction problem in welding sheet metal and suggestions for overcoming difficulties caused by it.—Industrial Gases, London, March.

WELDING OF COPPER BY THE OXY-ACETYLENE PROCESS, by A. Eyles—The preparation of copper for welding and special devices followed to accomplish different types of welds.—Industrial Gases, London, March.

OXY-ACETYLENE WELDING OF COPPER, by C. S. Smith—Poor qualities of oxy-acetylene welds in copper are due to the brittle zone in the unmelted, but overheated metal immediately adjoining the zone of fusion. This can be removed by a suitable thermal and mechanical treatment. Oxidation need not be an important factor, but the addition of certain elements to the filler rod is necessary to insure sound metal in the joint.—Industrial Gases, London, March.

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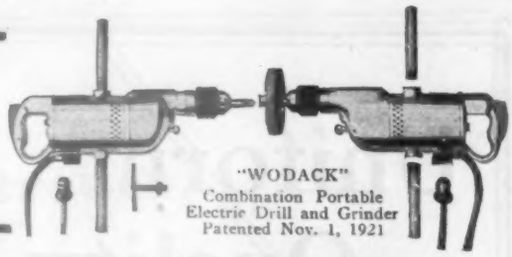

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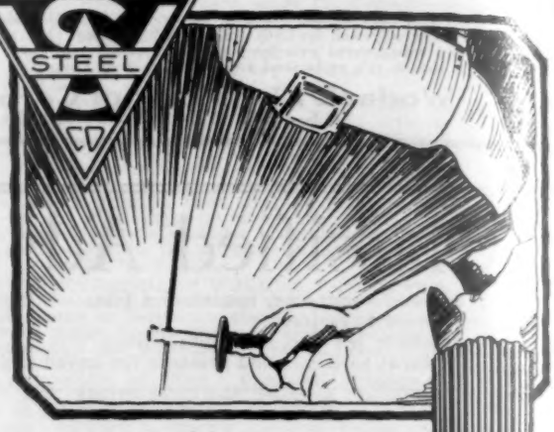

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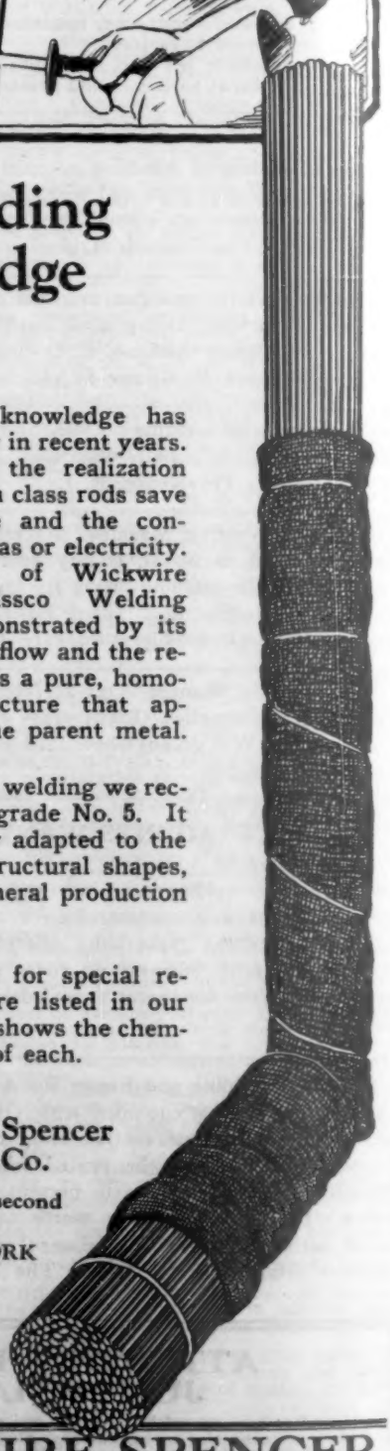

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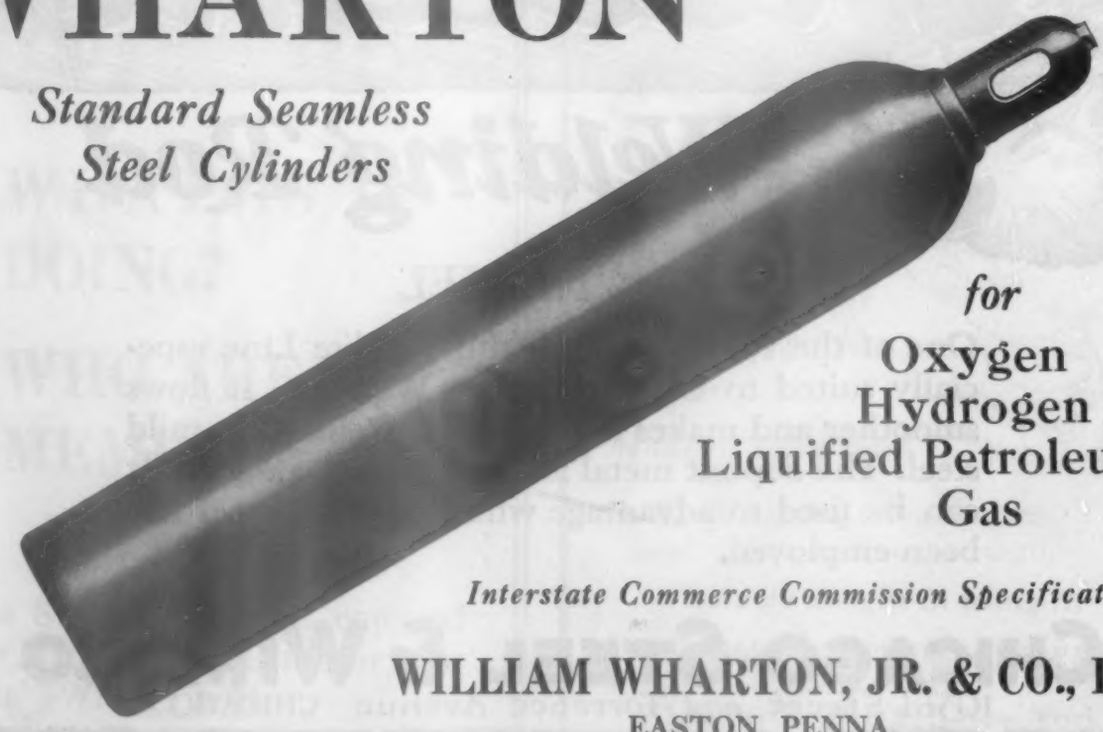

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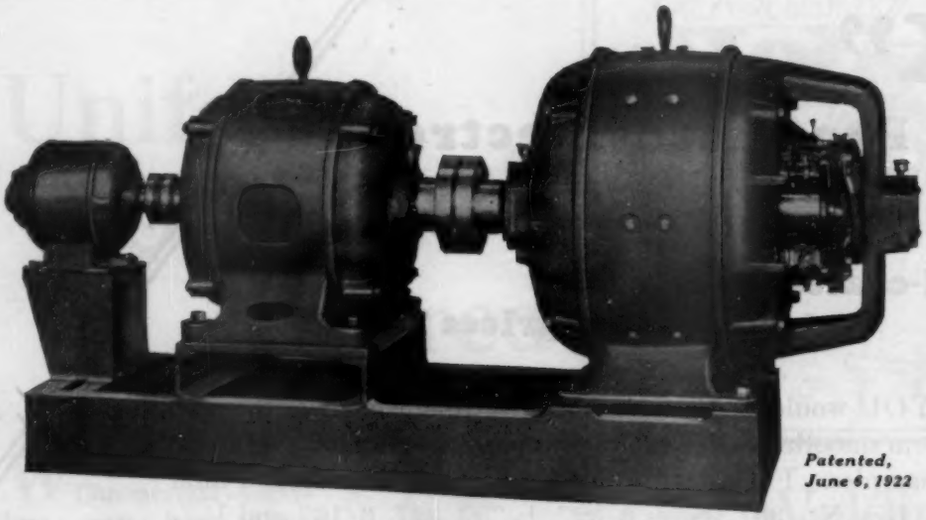

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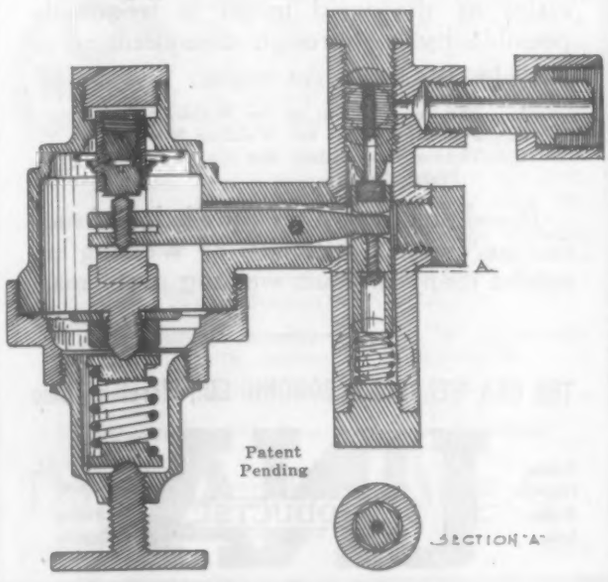

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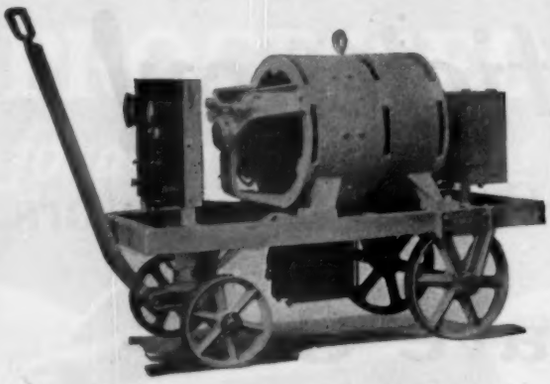

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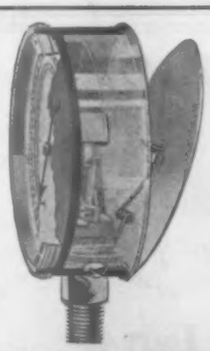

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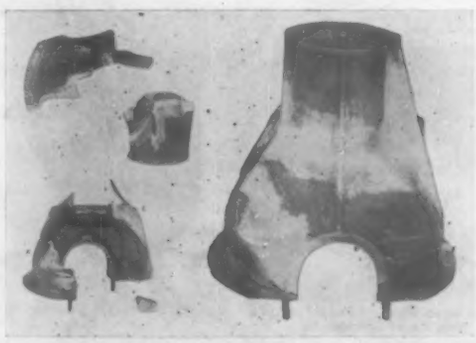

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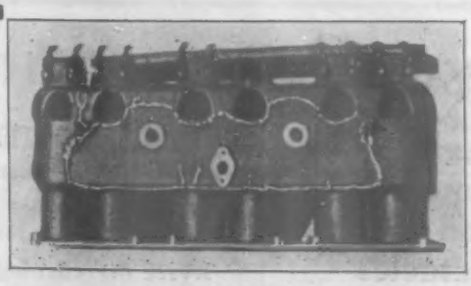
The Aluminum Fix Company

1964 East 55th Street, Cleveland, Ohio, U. S. A.



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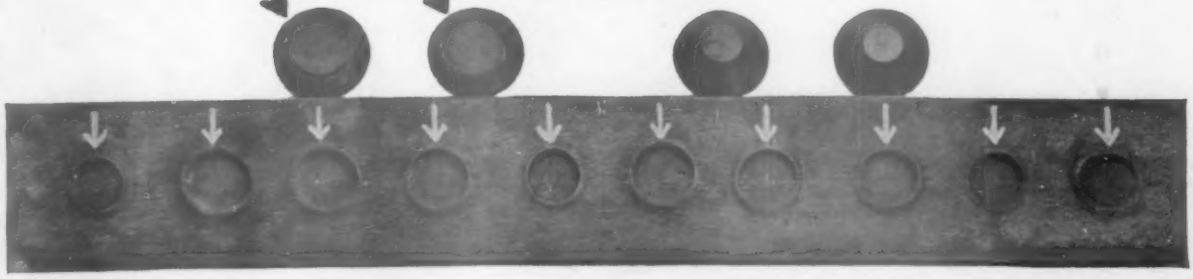
Facts Talk No 3

TWO PIECES OF HALF INCH BOILER PLATE SPOT WELDED TOGETHER

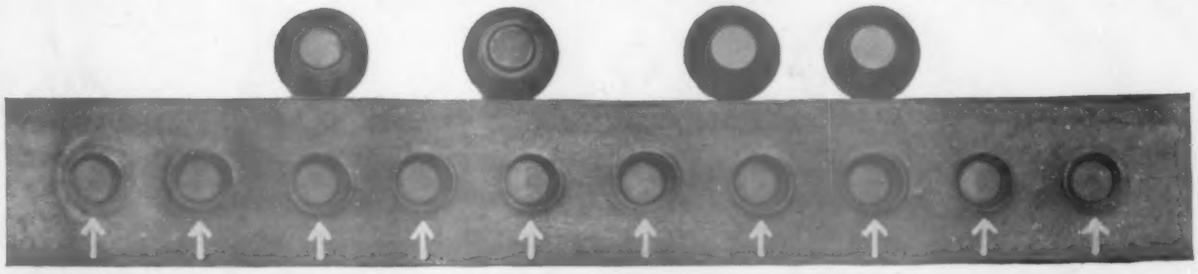
(1) With Copper Electrodes

MUSHROOMS AT TIP



(2) With Elkonite Electrodes

PERFECT WELDS



Constant Hardness and Stability Under Red Heat

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These qualities are common to all Elkonite Welding Electrodes. Other characteristics of the Elkonite series may be varied to meet special conditions which present themselves in resistance welding.

If you are having trouble with hard drawn copper let our laboratory staff advise with you

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BRASS
TINNED IRON
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commercially practical for the first time.

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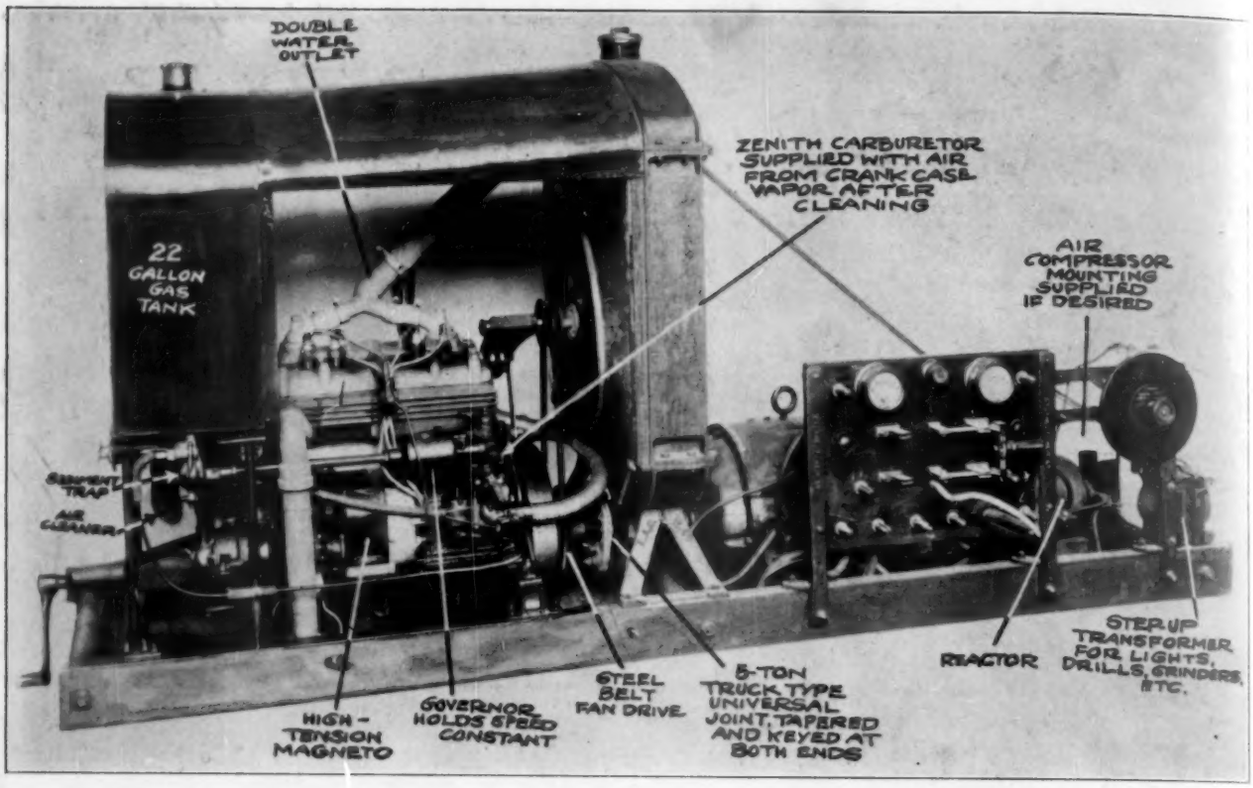
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AIR COMPRESSOR MOUNTING SUPPLIED IF DESIRED
SEDIMENT TRAP
AIR CLEANER
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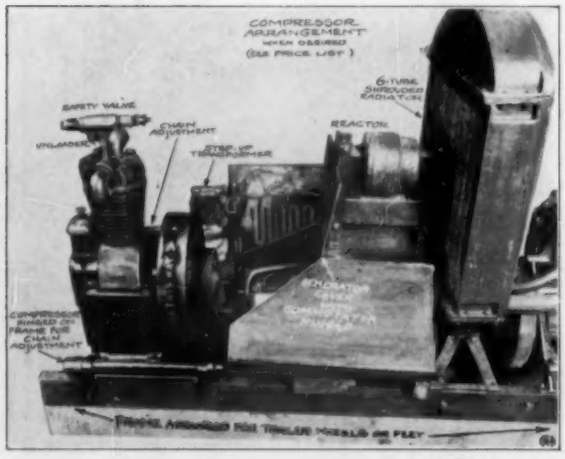
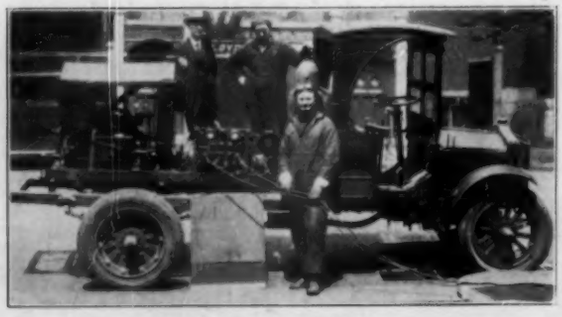
5-TON TRUCK TYPE UNIVERSAL JOINT, TAPERED AND KEYED AT BOTH ENDS
REACTOR
STEP-UP TRANSFORMER FOR LIGHTS, DRILLS, GRINDERS, ETC.



Close up Air Compressor Attached to Dualarc Generator.



A complete Dualarc Outfit Ready for Action.

The DUALARC Welding Generator Has Everything

As illustrated at the left, it can be furnished with an air compressor for one or two airguns, as desired; the gas engine has adequate power to carry both loads. The Dualarc Welding Generator itself has the following

Exclusive Features

1. Alternating current for the Semi-Arc Process, nickel spotting, resistance welding, spot welding, butt welding, pipe thawing, etc.

2. Reversible differential field for 20 volt metallic arc and 40 volt carbon arc.

3. Overloading is impossible. Beyond the generator rating the voltage dies away, removing the load, returning immediately when normal operation is resumed.

4. The compound field arrangement allows the arc to be operated at great distances from the generator without affecting control or efficiency in any way. With ordinary wire operation from one-half to one mile distance from the machine, depending on the continuity of contact, is guaranteed.

5. By reversing the series field increased arc pressure can be obtained, giving extra penetrating voltage for out door work or work on dirty metal.

6. A step-up transformer can be used for lights, drills, grinders, electric chipping hammers, etc.

7. Ball-bearing construction and interpole field.

The Dualarc Generator is driven by a gas engine with sufficient reserve power to operate an air compressor up to 10 H. P. if desired. Many gas engine sets just have engine capacity for the welding only.

Electric Arc Cutting & Welding Co.
152-158 Jelliff Avenue, Newark, New Jersey